LOUISIANA

REASONABLY FORESEEABLE DEVELOPMENT SCENARIO FOR FLUID MINERALS

Prepared for:

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
EASTERN STATES
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The Bureau of Land Management is responsible for the stewardship of our public lands. It is committed to manage, protect, and improve these lands in a manner to serve the needs of the American people for all times. Management is based on the principles of multiple use and sustained yield of our nation's resources within a framework of environmental responsibility and scientific technology. These resources include air, fish and wildlife, minerals, paleontological relics, recreation, rangelands, scenic scientific and cultural values, timber; water, and wilderness.

BLM/ES/PL-08/XXX

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ACRONYMS

ACEC	Area of Critical Environmental Concern
AOGC	Arkansas Oil and Gas Commission
APD	Application for Permit to Drill
AU	Assessment Units
BCF	billion cubic feet
BLM	Bureau of Land Management
BOPD	barrels of oil per day
CBNG	Coal Bed Natural Gas
EIS	Environmental Impact Statement
EOR	Enhanced Oil Recovery
ESA	Endangered Species Act
EIS	Environmental Impact Statement
AOGC	Arkansas Oil and Gas Commission
JFO	Jackson Field Office
MMBO	million barrels of oil
ROD	Record of Decision
RMP	Resource Management Plan
SMA	Surface Management Agency
TCF	trillion cubic feet
TPS	Total Petroleum Systems
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	U.S. Geological Survey

Summary

1.0 INTRODUCTION

The Bureau of Land Management's Jackson Field Office is located in Jackson, Mississippi, and is responsible for 11 southern states: Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, and Virginia. The Jackson Field Office manages approximately 34.25 million acres of federal mineral estate in the eastern portion of the United State. Of this approximately 6.5 million mineral acres are located in Louisiana where oil and gas leases are active in the Kisatchie National Forest, Barksdale Air Force Base, Fort Polk, and Delta National Wildlife Refuge.

The Reasonable Foreseeable Development Scenario (RFDS) forecasts fluid mineral exploration, development, and production for the planning area for the next 10 years. The RFDS assumes a baseline scenario in which no new policies are introduced and all areas not currently closed to leasing and development are opened for oil and gas activity.

Interagency Reference Guide - Reasonably Foreseeable Development Scenarios and Cumulative Effects Analysis for Oil and Gas Activities on Federal Lands in the Greater Rocky Mountain Region" (USDI 2002), "Policy for Reasonably Foreseeable Development Scenario (RFD) for Oil and Gas (BLM WO IM No. 2004-089) and Planning for Fluid Minerals Supplemental Program Guidance (BLM Handbook H-1624-1) guided the criteria and analyses methods used in this RFD.

1.1 Discussion of Determining Oil and Gas Resource Potential

Potential accumulations of oil and gas are described in Section 2. Non-BLM land within the state may be included in this section when it provides a better understanding of resource potential on BLM property. These determinations were made using the geologic criteria provided by reference in Section 2. Also contained in Section 2 are descriptions of stratigraphy, structure, historic oil and gas activities, as well as relevant studies done in the area. Potential reservoir rocks, source rocks, and existing stratigraphic and structural traps are discussed in detail.

1.2 Methodology for Predicting Future Oil and Gas Exploration and Development Activity

Section 7 predicts the type and intensity of future oil and gas exploration and development activities. These forecasts are determined by an area's geology, and historical and present activity, as well as factors such as economics, technological advances, access to oil and gas areas, transportation, and access to processing facilities. Economics, technology, and other factors may be hard to predict because of their complex nature and rapid rate of change. Projections of oil and gas activities are based upon present knowledge. Future changes in global oil and gas markets, infrastructure and transportation, or technological advancements, may affect future oil and gas exploration and development activities within the state.

1.3 Relating the Potential for Resource Occurrence to Potential for Activity

Predicted oil and gas activity does not necessarily correlate with geologic potential for the presence of hydrocarbons. Although the geology of an area may suggest the possibility of oil and gas resources, actual exploration and development may be restricted by high exploration costs, low oil and gas prices, or difficulty accessing the area due to lease stipulations. Thus a small area may have a high resource potential, yet have a low exploration and development potential due to severe restrictions on access. Conversely, technological advancements or an increase in oil and gas prices could result in oil and gas activities in areas regarded as having low potential for occurrence.

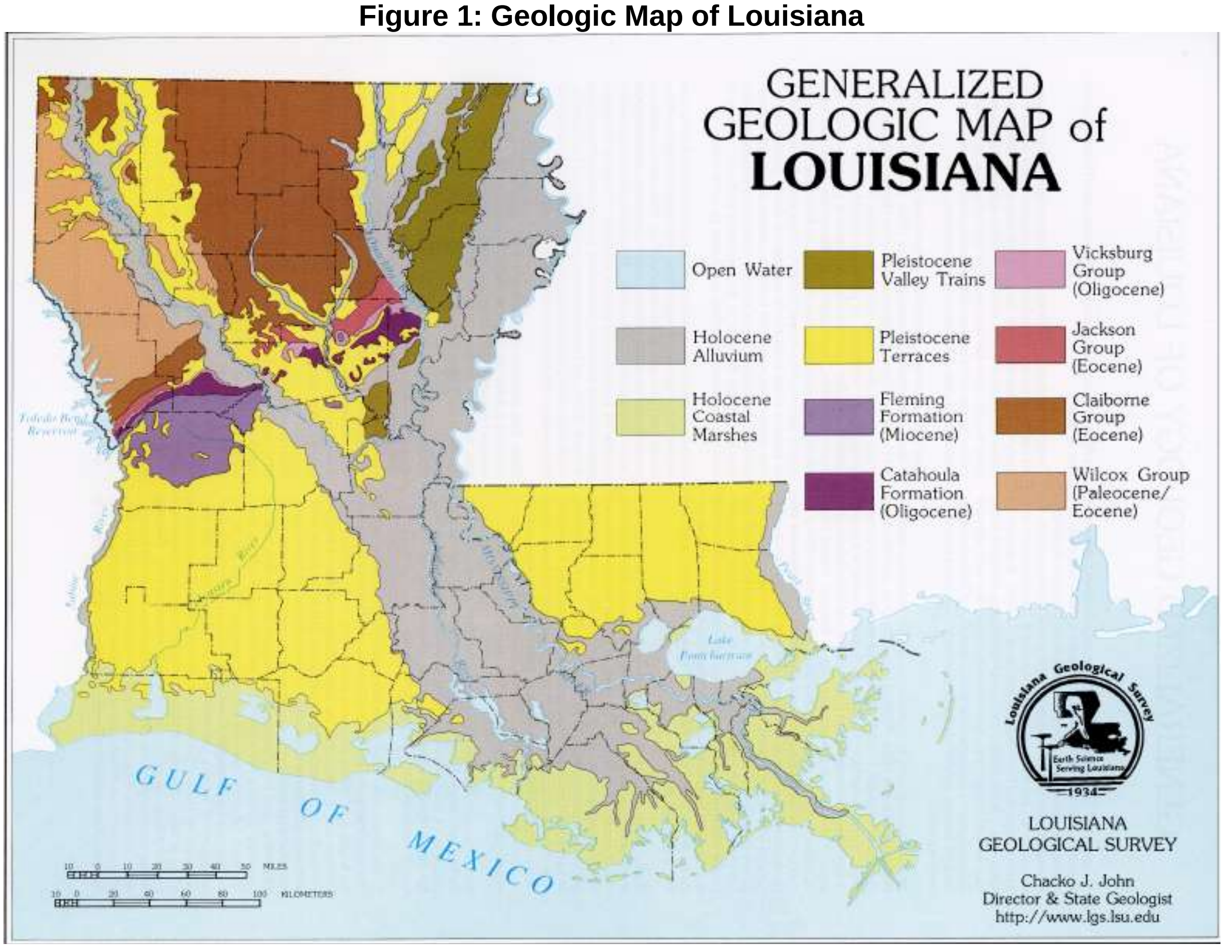
2.0 Description of the Geology of Louisiana

Louisiana is entirely made of Mississippi mud, and its surface rocks go back some 50 million years. As the seas rose and fell over this low-lying region, some version of the Mississippi was carrying vast sediment loads here from the core of the North American continent and piling it on the rim of the Gulf of Mexico. Organic matter from highly productive marine waters has been deeply buried under the whole state and far offshore, turning into petroleum. During other dry periods, large beds of salt were laid down through evaporation

The older outcrops dip downward toward the sea owing to the steady subsidence of the land, and the coast is very young indeed. You can see how much the Holocene alluvium of the Mississippi River covers the state. The Holocene represents only the latest 10,000 years of Earth history, and in the 2 million years of Pleistocene time before that the river has wandered over the whole coastal region many times.

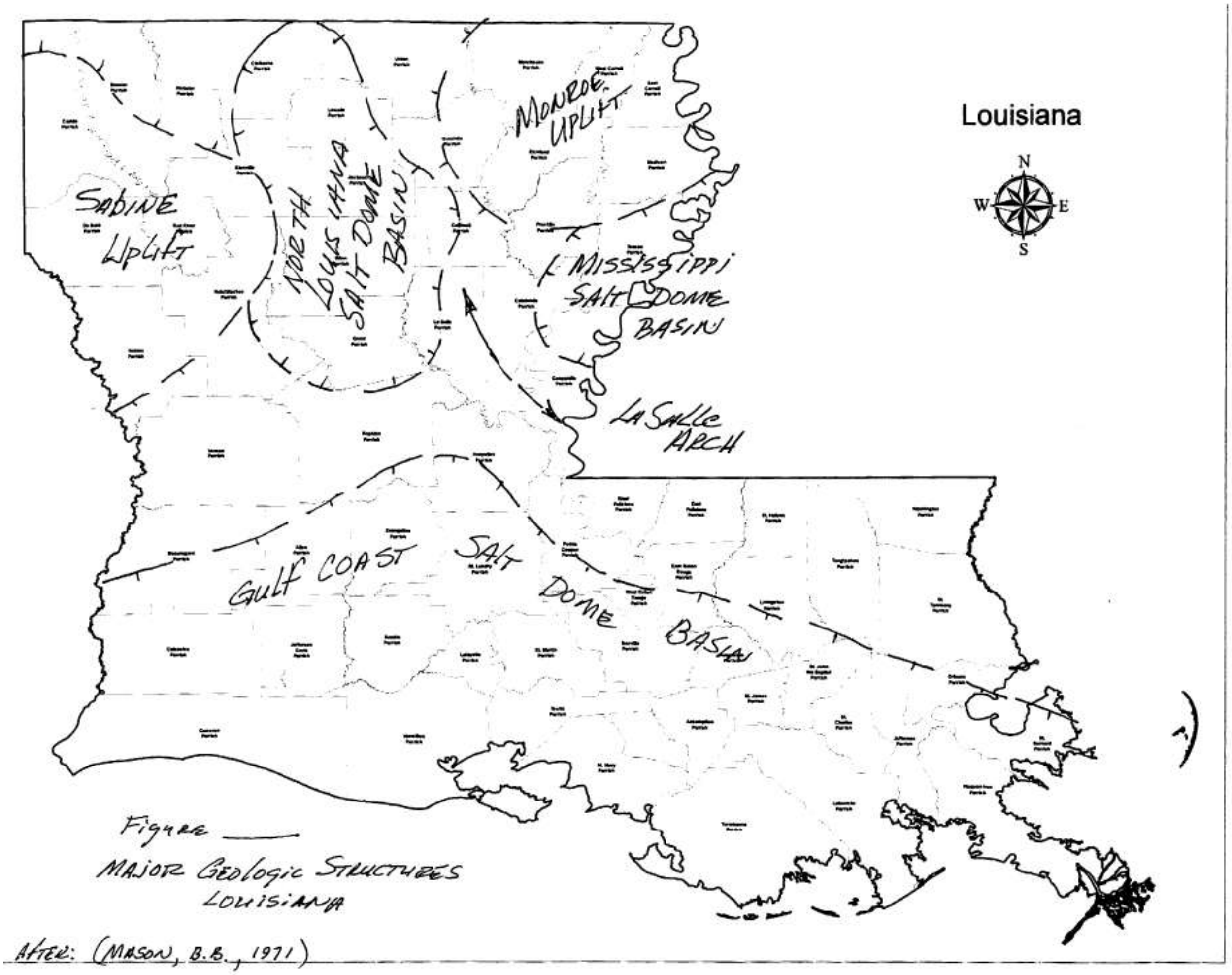
Sediment and poorly lithified rock units that are exposed at the surface in Louisiana generally include units that are Cenozoic in age and belong to either the Quaternary or Tertiary systems. A few exposures of Mesozoic (upper Cretaceous) xenoliths have been identified at the surface at a few piercement salt domes in the northern part of Louisiana but are not significant in terms of the total mass of exposed mapable units, (Louisiana Geological Survey, 2000).

Figure 1: Geologic Map of Louisiana



Source: Louisiana Geological Survey 2005

Figure 2: Structural Elements of Onshore Louisiana



Source: Mason, 1971

Tertiary units exposed at the surface range in age from Paleocene to Miocene (*Figure 1*). Strata of the Paleocene Wilcox, Eocene Claiborne, and Miocene Fleming Groups cover the largest surface area. These outcrop bands represent the step-wise shallowing of the Gulf of Mexico and are controlled by the gross structural features on the state (*Figure 2*) that split the state into several basins and intervening positive structural elements. Terrestrial and marine exposures of the Wilcox Group dominate on the Sabine uplift of northwestern Louisiana. Exposures of the Claiborne Group predominate in the area of the north Louisiana salt-dome basin. Fleming Group exposures are isolated on the southeastern flank of the Sabine uplift.

The Wilcox and Claiborne units exposed at the surface consist primarily of clastics deposited in deltaic and shallow marine environments. The Jackson and Vicksburg strata, which at the surface are bracketed by the underlying and overlying Claiborne and Miocene units, consists primarily of mudstone. These units are relatively thin, and are exposed in narrow outcrop belts southeast of the Sabine uplift. The next youngest unit exposed at surface is the Catahoula Formation, which is predominantly fluvial sandstone. Much of this sandstone unit is hard, and the surface exposures are characterized by resistant ridges and dissected hills locally referred to as the Kisatchie Wold, denoting a line of hills held up by resistant strata.

The Miocene aged Fleming Group includes both sandstones and mudstones. No Pliocene strata have been definitely identified as the surface, although the sediment sequence underlying the oldest and highest of the Pleistocene terrace surfaces is thought to probably include some Pliocene deposits.

Quaternary aged sediment laid down during the Pleistocene and Holocene account for most of the surface exposures in Louisiana. The Pleistocene sediments are associated with terrace and outwash deposits and consist primarily of sand, gravel and mud. The Holocene sediments are alluvium deposits associated with the major river systems and tributaries or coastal marsh deposits consisting chiefly of mud and organic material.

2.1 Subsurface Stratigraphy and Structure

The subsurface stratigraphy and structure related to the occurrence of fluid mineral resources for onshore Louisiana is normally divided into two primary regions or sub-provinces that include: the northern Louisiana region (including Sabine Uplift, Northern Salt Dome Basin, Monroe Uplift, Mississippi Salt Dome Basin, and La Salle Arch) and the southern Louisiana region (Gulf Coast Salt Dome Basin) as shown in Figure 2.

These two regions generally possess three fundamental differences that affect the exploration and exploitation methodologies that are applied and the economics of those methodologies. The dissimilarities between the two regions are: 1) the age and lithologies of the producing formations, 2) the hydrocarbon fluids that are produced, and 3) the depth of the producing reservoirs. In addition to these differences the two regions are also structurally separated in that they are affected by dissimilar regional structural features. The northern portion of the state contains a variety of structural and stratigraphic traps while the southern Louisiana producing region is dominated by down-to-the-basin fault trends and structures associated with numerous piercement salt domes (Mason, 1971). The bulk of the producing reservoirs in the northern region ranges from Jurassic to Paleogene strata is generally older than that in the southern onshore region where Neogene formations are predominant.

Table 1 provides an overall comparison between the northern onshore region and the southern onshore region with respect to reservoir age and lithologies, predominate hydrocarbon type, and average drilling depths (Goddard, D.A., 2001). The southern region produces more oil, slightly less gas and contains larger reserves but the north region has received more drilling in the past several years.

Table 1: Comparison Northern Louisiana and Southern Louisiana Onshore Regions

	Northern Onshore Region	Southern Onshore Region
Reservoir Age	Jurassic and Paleogene	Paleogene and Neogene
Reservoir Lithology	Clastics and Carbonates	Clastics
Hydrocarbon Type	Oil and Associated Natural Gas	Generally More Oil Prone than Gas
Average Depth	6,000 Ft.	12,000 Ft.
Reserves	108 million Bbl oil, 3.079 TCF	384 million Bbl oil, 5.535 TCF
Major Oil Parishes	La Salle, Caddo, Claiborne, and Bossier	Plaquemines, LaFourche, and Terrebonne
Major Gas Parishes	Bossier, DeSoto, Bienville, and Jackson	Terrebonne, Plaquemines, Vermilion, and Cameron
Drilling 2007	1587 wells	655 wells
Production 2007	13.87 million bbl, 636 BCF	58.35 million bbl, 626 BCF

Source: Goddard, D.A., 2001 and LNDR, 2008

2.1.1 Northern Onshore Region

Figure 3 is a stratigraphic column for the Northern Onshore Region. Production within this region is mainly supported by Cretaceous reservoirs although considerable production also occurs from Jurassic (Cotton Valley – Smackover) and Paleogene (Wilcox) sediments. A total of 945 fields are included in the region. The four largest Parishes by oil production are La Salle, Caddo, Claiborne, and Bossier. The largest natural gas Parishes are Bossier, DeSoto, Bienville, and Jackson.

2.1.2 Southern Onshore Region

Southern Louisiana coincides with the Gulf Coast Salt Dome Basin. The stratigraphic column is diagrammed in Figure 4. The older Cretaceous and Jurassic strata discussed above are buried well past the depth of routine oil and gas drilling. The sediments across the Louisiana portion of the Gulf Coast Salt Dome Basin are Tertiary in age, dominated by marine sands and shales. Structures within the basin are down-to-the-basin low-angle faults and diapiric salt features.

Figure 3: Generalized Stratigraphic Column Northern Louisiana

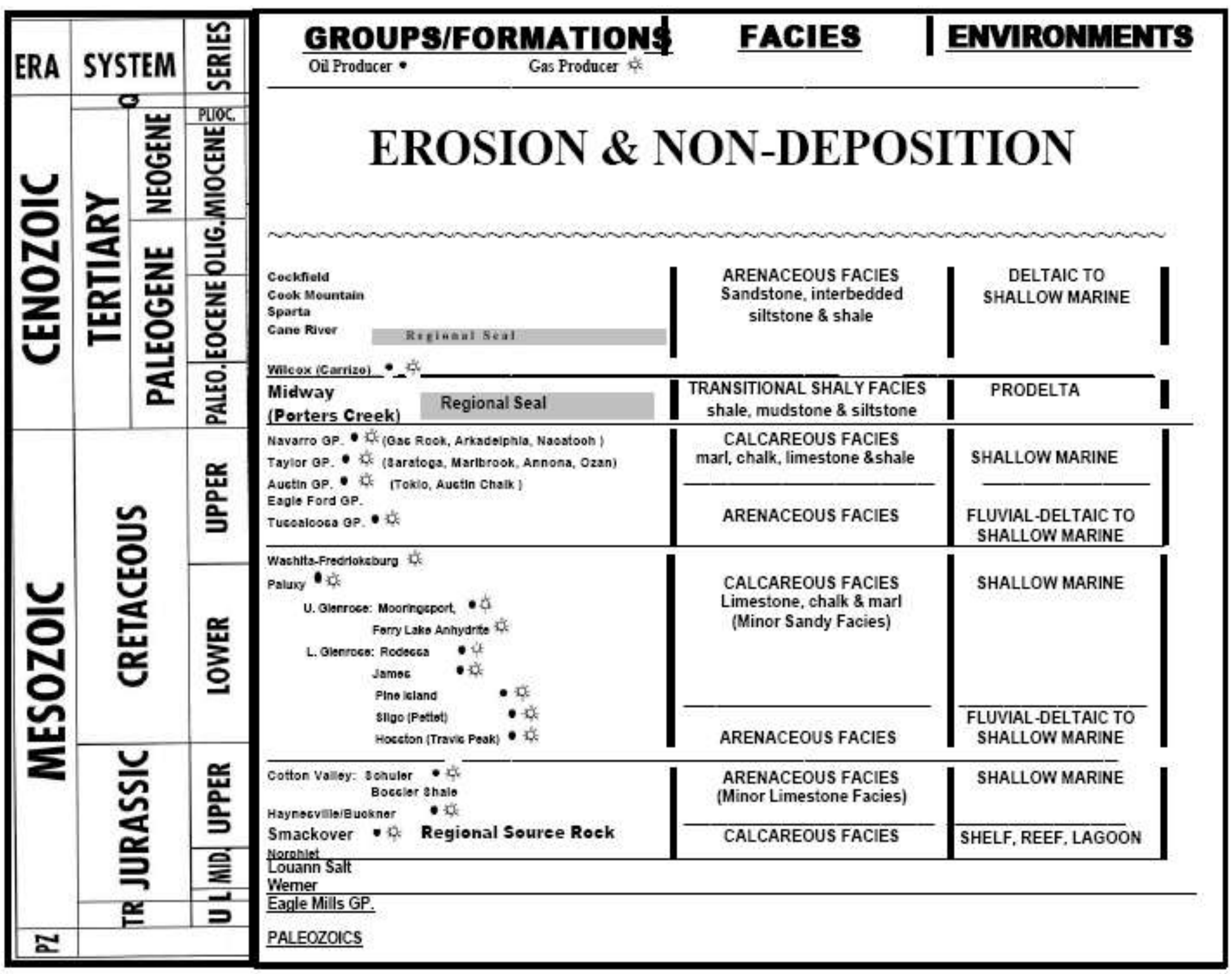
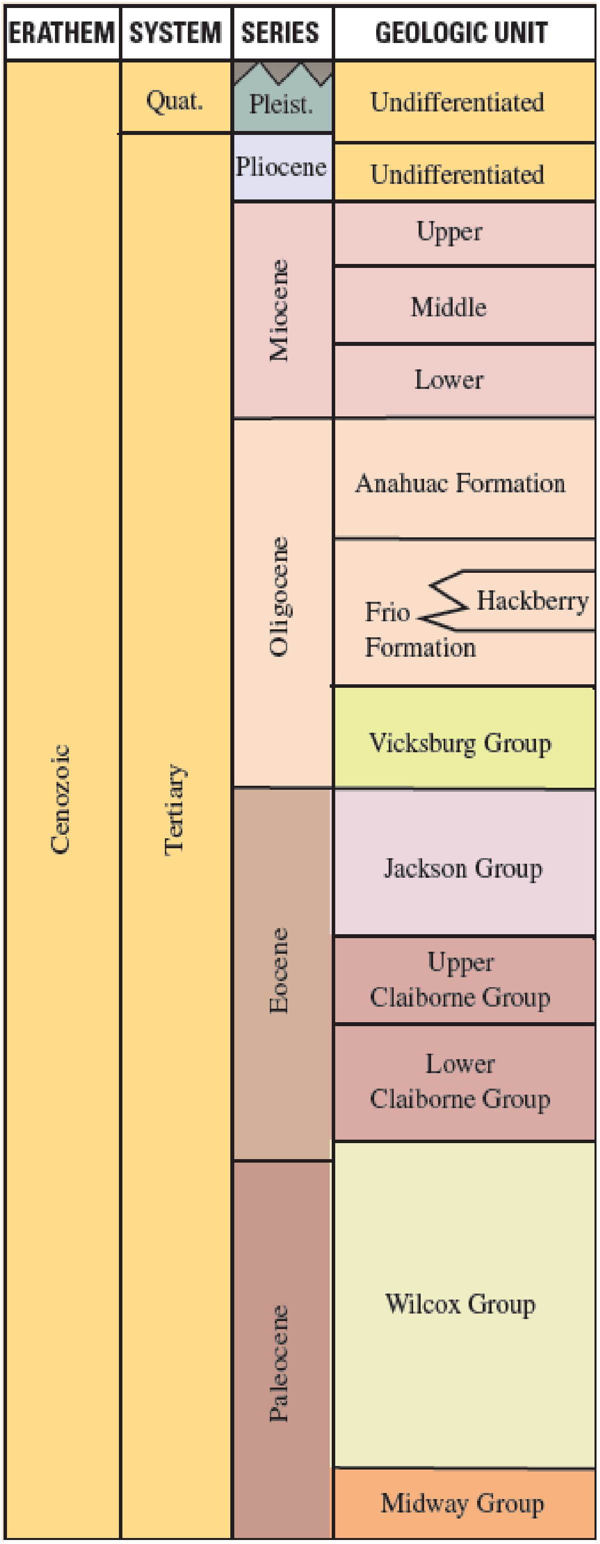


Figure 4: Stratigraphic Column Southern Louisiana



Source: USGS, 2008.

3.0 SUMMARY OF USGS PLAY DESCRIPTIONS

3.1 Oil and Gas Assessment

The USGS National Oil and Gas Assessment is a program designed to assess the undiscovered oil and natural gas resources in the United States. Ongoing USGS investigations in Louisiana include developing the sequence stratigraphy of the Tertiary of southern Louisiana, the geologic characterization of the Austin Chalk, and porosity evolution of deep Tuscaloosa sandstones, all of which provide geologic information for further assessment activities.

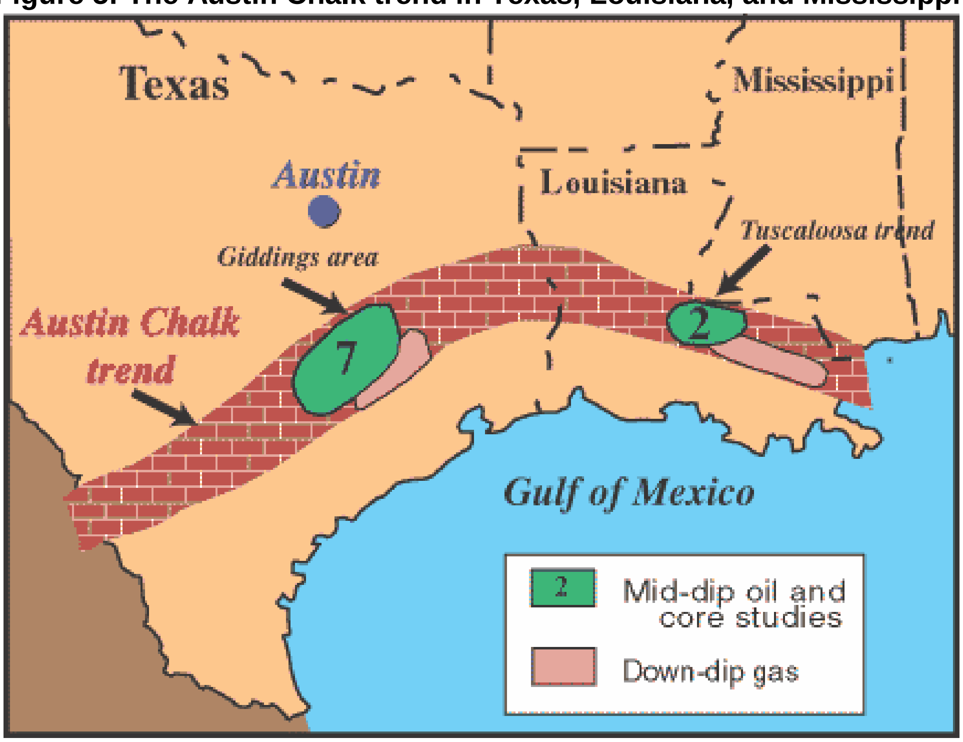
In 1995, the USGS determined that the Austin Chalk is our Nation's largest, onshore domestic unconventional, continuous-type oil resource. More recently, exploration and production in frontier areas of Texas and Louisiana (figure 5) have shown that the Austin Chalk has additional potential as a continuous-type deep-gas resource mostly to the east and downdip of existing oil plays.

The USGS is studying the geologic framework, stratigraphy, lithology, and the burial and production histories of the Austin Chalk to assess the quantitative estimate of this large domestic resource. Distribution of the Austin Chalk from framework studies will assist in outlining geographic extent, among other factors, to identify current and frontier exploration target areas.

3.2 Identified Play Areas Exclusive to Western Gulf Province (047)

Province 47 comprises the Western Gulf area, which contains the portion of Louisiana south of the Lower Cretaceous shelf edge, and Texas south and east of the Ouachita Fold Belt. The boundaries include the Ouachita Fold Belt, the southern boundary of East Texas Basin Province (048), the southern boundary of the Mississippi-Louisiana Salt Basins Province (049), the offshore 3-league (10.36-mile) limit in Texas, and the offshore 3-mile limit in Louisiana. The southwest boundary is the Texas-Mexico border. The area of the Western Gulf is 116,599 sq mi.

Figure 5: The Austin Chalk trend in Texas, Louisiana, and Mississippi.



The Western Gulf is one of the most heavily explored provinces in the country. Data from approximately 227,000 dry holes, 235,000 oil wells, and 105,000 gas wells are available. Exploration has led to the discovery of 2,518 significant oil and gas fields, comprising 3,883 significant oil and gas reservoirs.

The Western Gulf Province has been divided into 48 hydrocarbon plays, with 3 plays in the Jurassic, 15 plays in the Cretaceous, and 30 plays in Tertiary rocks; all but 3 plays are conventional. The following is a list of plays in Louisiana:

- 4719 Lower Wilcox Fluvial Oil and Gas
- 4720 Lower Wilcox Downdip Overpressured Gas
- 4722 Upper Wilcox Shelf-Edge Gas and Oil
- 4723 Upper Wilcox Downdip Overpressured Gas
- 4724 Middle Eocene Sandstones Downdip Gas
- 4725 Middle Eocene Sandstones Updip Fluvial Oil and Gas
- 4728 Jackson Updip Gas and Oil
- 4729 Jackson Downdip Gas
- 4730 Vicksburg Updip Gas
- 4731 Vicksburg Downdip Gas
- 4734 Frio Updip Fluvial Gas and Oil
- 4735 Frio SE Texas/S. Louisiana Mid-Dip Gas and Oil
- 4736 Frio SE Texas/S. Louisiana Downdip Gas
- 4738 Anahuac Sandstone Gas and Oil
- 4740 Lower Miocene Deltaic Sandstone Gas and Oil
- 4741 Lower Miocene Slope and Fan Sandstone Gas

A brief description of each play including play concept, reservoirs, source rocks, traps, and exploration status and resource potential is included in Appendix A in a report titled *Western Gulf Province (047)* (Schenk & Viger, 2001)

3.3 Identified Play Areas – East Texas Basin Province (048) and Louisiana-Mississippi Salt Basins Province (049)

Province 48 comprises the East Texas area, which is that portion of eastern Texas north of the Angelina Flexure, and east of the Ouachita Fold Belt. Province 49 includes southern Arkansas, northern Louisiana, southern Mississippi, southern Alabama, and the Florida Panhandle west of the Apalachicola River and is known as the Mississippi-Louisiana Salt Basins. For the 1995 National Assessment, provinces 48 and 49 were combined because many of the plays extended across the rather artificial province boundary between them, which is the State line between Texas and Louisiana.

The boundaries of the combined provinces are (1) the State Federal water boundaries, which are the 3-league (10.36-mile) limit in Florida and the 3-mile limit in Alabama and Mississippi, (2) the Appalachian Front in Alabama, (3) the southern edge of the Black Warrior Basin in Alabama and Mississippi, (4) the Ouachita Front in southern Arkansas and east Texas, and (5) the Lower Cretaceous shelf edge in southern Mississippi and southern Louisiana. The area of the combined provinces is 131,065 square miles.

Significant geologic features of the combined provinces include the Sabine, LaSalle, Monroe, Wiggins-Hancock, Baldwin, and Jackson positive elements, the regional peripheral fault zones, and the numerous salt domes and salt structures that define these provinces. Another unique feature of the combined provinces is the great thickness of the Middle Jurassic Louann Salt, which significantly affected the petroleum geology of the area.

The 1995 assessment includes 47 plays in the combined provinces. Of these, 24 plays are Jurassic or older, 20 are in the Cretaceous, and 3 are in Tertiary rocks. Play definition was done stratigraphically, and most stratigraphic units were considered independently, not in combination with other units. The following is a list of plays in Louisiana:

4912 Smackover Salt Basins Gas and Oil Play
4915 Smackover North Louisiana Gray Sandstone Gas Play
4918 Haynesville Salt Basins Gas and Oil Play
4921 Cotton Valley Updip Oil Play
4922 Cotton Valley Salt Basins Gas Play
4923 Cotton Valley Blanket Sandstones Gas Play
4924 Cotton Valley Sabine Uplift Gas Play
4927 Travis Peak Sabine Uplift Gas Play
4929 Sligo/Pettet Salt Basins Gas Play
4930 Pettet Southern Sabine Uplift Oil and Gas Play
4931 James Limestone Gas Play
4932 Glen Rose/Rodessa Updip Oil Play
4933 Glen Rose/Rodessa Salt Basins Gas Play
4934 Paluxy Updip Oil Play
4935 Paluxy Downdip Gas Play
4937 Tuscaloosa/Woodbine Structural Oil and Gas Play
4938 Tuscaloosa Stratigraphic Oil and Gas Play
4941 Eutaw Southern Salt Basins Gas Play
4942 Austin Oil Play 4943 Selma Salt Basins Oil Play
4945 Wilcox Salt Basins Oil Play
4946 Wilcox Northern Louisiana Salt Basin Gas Play
4947 Mobile Bay Miocene Gas Play

The level of exploration in the combined provinces can be judged from the number of dry holes (about 80,000), oil wells (about 70,000), and gas wells (about 35,000), for a conservative total of about 186,000 wells. This exploration has resulted in the discovery of 971 significant oil and gas fields, consisting of 1,477 significant oil and gas reservoirs. Some of the largest fields include Monroe (7.5 TCFG) and East Texas (6,374 MMBO).

A brief description of each play including play concept, reservoirs, source rocks, traps, and exploration status and resource potential is included in Appendix A in a report titled *East Texas Basin Province (048) and Louisiana-Mississippi Salt Basin Province (049)* (Schenk & Viger, 2001)

4.0 PAST AND PRESENT OIL AND GAS EXPLORATION ACTIVITY

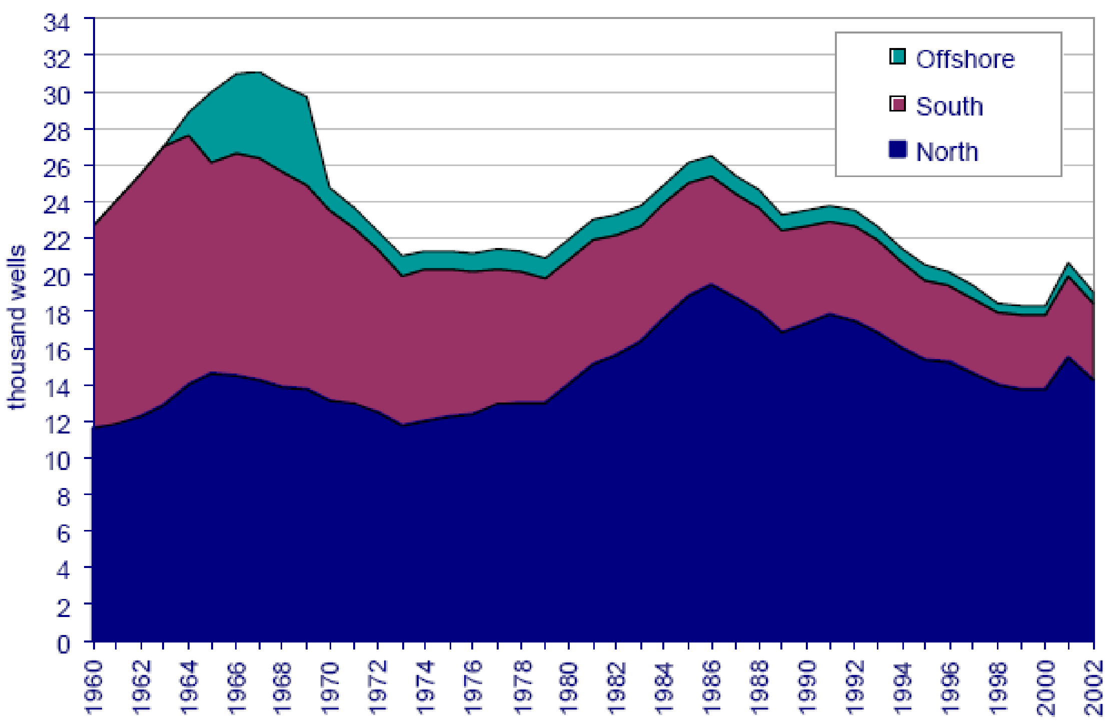
4.1 Drilling Activity

Drilling varies from region to region in Louisiana. Figures 6 and 7 graph the changing number of active oil and gas wells in the state; the number of active wells is a function of both new drilling and also newly abandoned wells. Taken together, these graphs show the net decrease in number of oil and gas wells in the southern region. At the same time the graphs show the large number of oil wells in the north and the huge increase in the number of gas wells in the north in response to rise in product price in 1980.

Figure 8 plots the statewide increase of drilling since 2000. The totals include oil and gas wells, dry holes, and injection wells. The majority of the wells are oil and gas wells. Slowly rising product prices since 2000 have propelled drilling from its low-point in 2002 to the high present-day levels. The number of wells drilled per year has more than doubled since 2002 but has lately flattened out with little more increases.

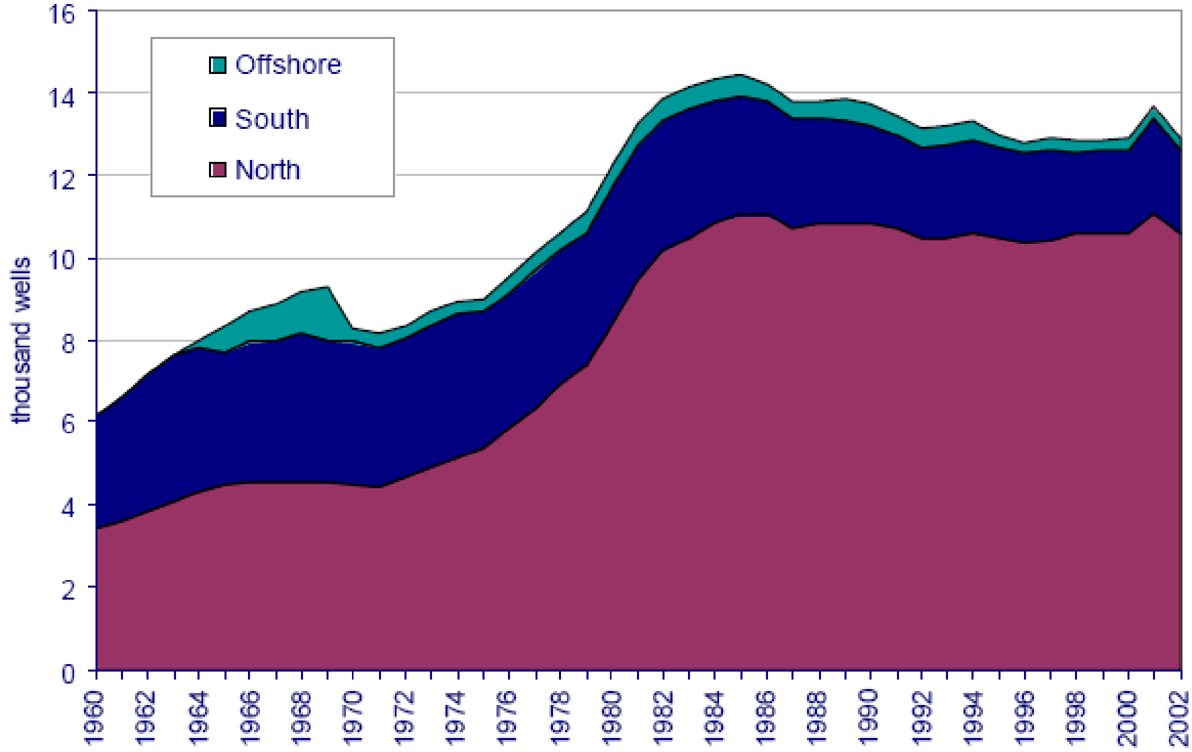
Figure 9 plots the total number of horizontal wells by parish; these wells are scattered across the state and their distribution is a matter of engineering dictated by surface conditions or subsurface geology.

Figure 6: Louisiana State Producing Crude Oil Wells



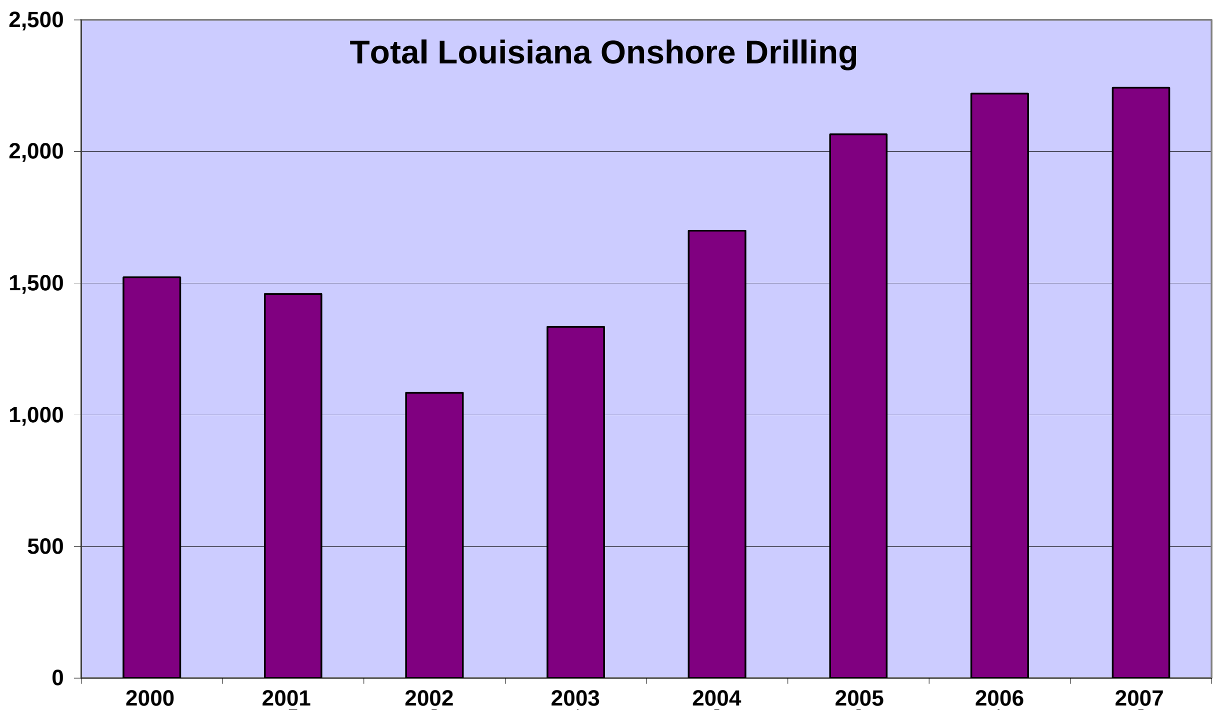
Source: LDNR, 2004

Figure 7: Natural Gas Wells in Louisiana



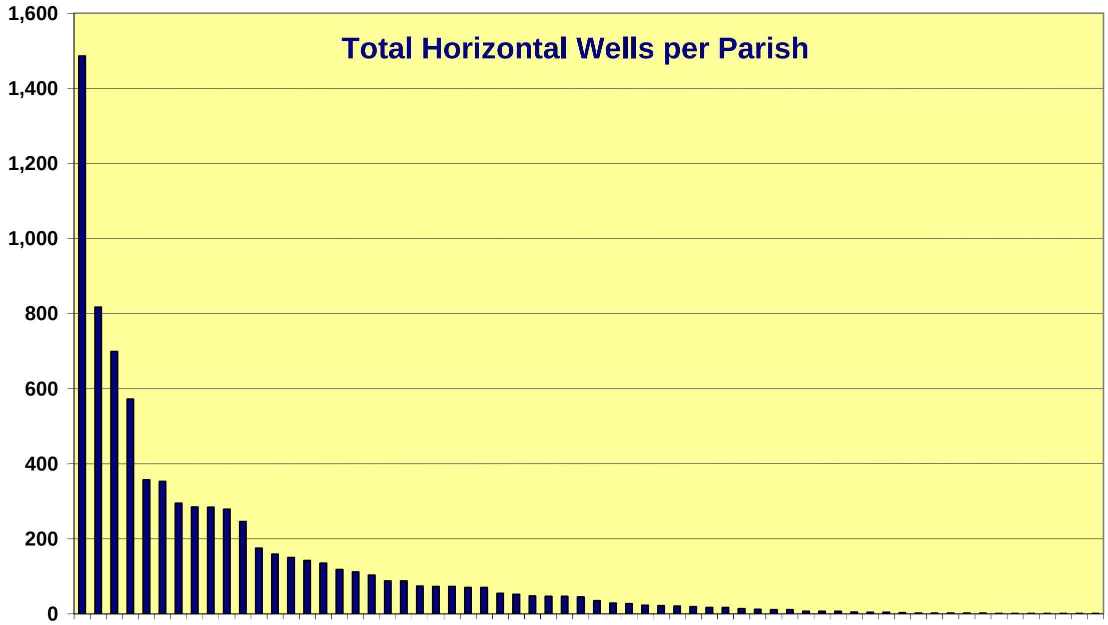
Source: LDNR, 2004

Figure 8: New Wells in Louisiana by Year (2000-2007)



Source: SONRISE Database

Figure 9: Total Wells per Parish with Horizontal Greater Than 200 feet



At the same time, Tertiary reservoirs in the Gulf Coast Salt Dome Basin of south Louisiana are often drilled directionally to avoid drilling into salt. As drilling moves south and approaches the coast, land becomes swampy and drill pads become difficult and expensive to drill. In those cases, several directional or horizontal wells are often drilled from one pad. This is the reason that Plaquimines Parish, at the mouth of the Mississippi River has the largest number of horizontal wells. The drilling forecasts that appear later in this report forecast the number of horizontal wells expected within each parish.

4.2 Exploratory Drilling and Success Rates

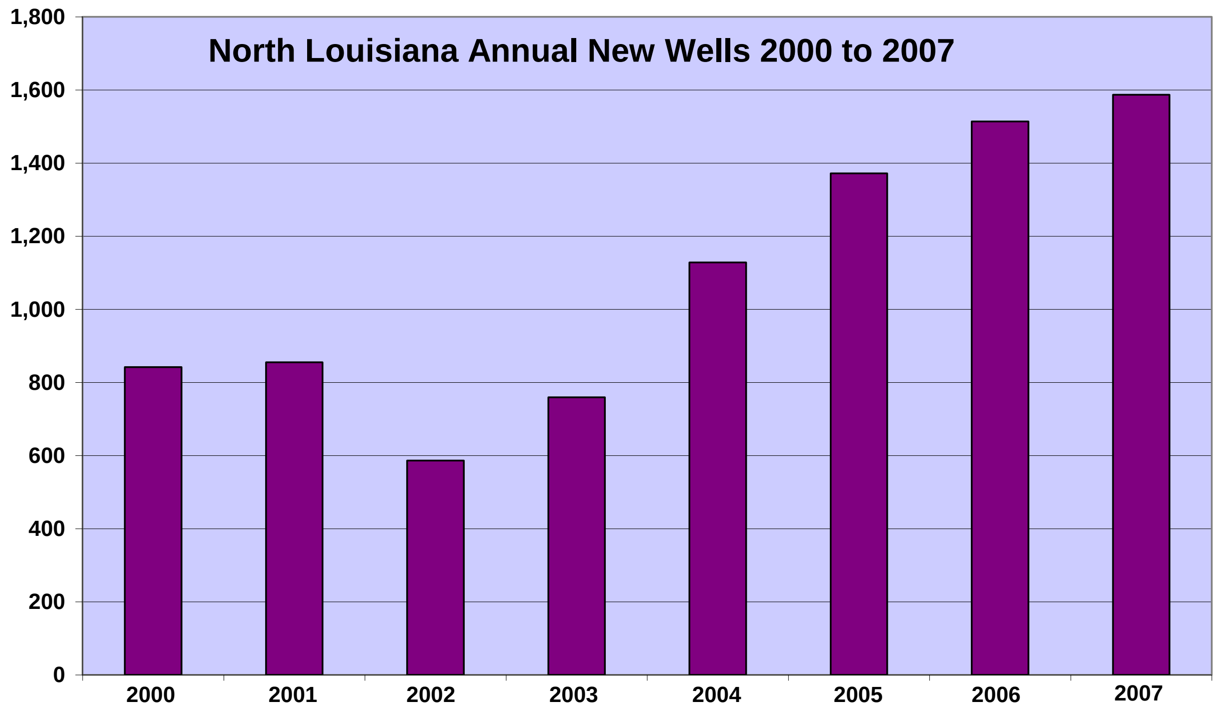
4.2.1 Northern Louisiana Region

Northern Louisiana is that portion of the state dominated by Cretaceous reservoirs at fairly deep drill—depths. The region has received the bulk of industry attention since 2000 and will likely continue to do so in the near future. Figure 10 plots the drilling and completion rates in the entire northern portion of the state by year from 2000 to 2007. Drilling in this region is exquisitely sensitive to oil and gas prices; the low-point of activity was 2002 but activity was almost three times as high in 2007 as shown on the plot. Figure 11 ranks the parishes of Northern Louisiana by drilling activity in the single year 2007. The most active parishes – Caddo, Bossier, and De Sotto – all drilled more than 250 wells last year and are located in the northwest corner of the state where the Cotton Valley and Smackover are being drilled and produced as more or less continuous reservoirs. The only other parishes that contained more than 100 new wells in 2007 are Lincoln and Bienville, both also located in the northern part of the state just to the east of the heart of the Cotton Valley plays. Many of the potential plays identified by the USGS and discussed in the next section are centered in the NW corner of the state in either the Sabine Uplift or North Louisiana Salt Basin areas.

4.2.2 Southern Louisiana Region

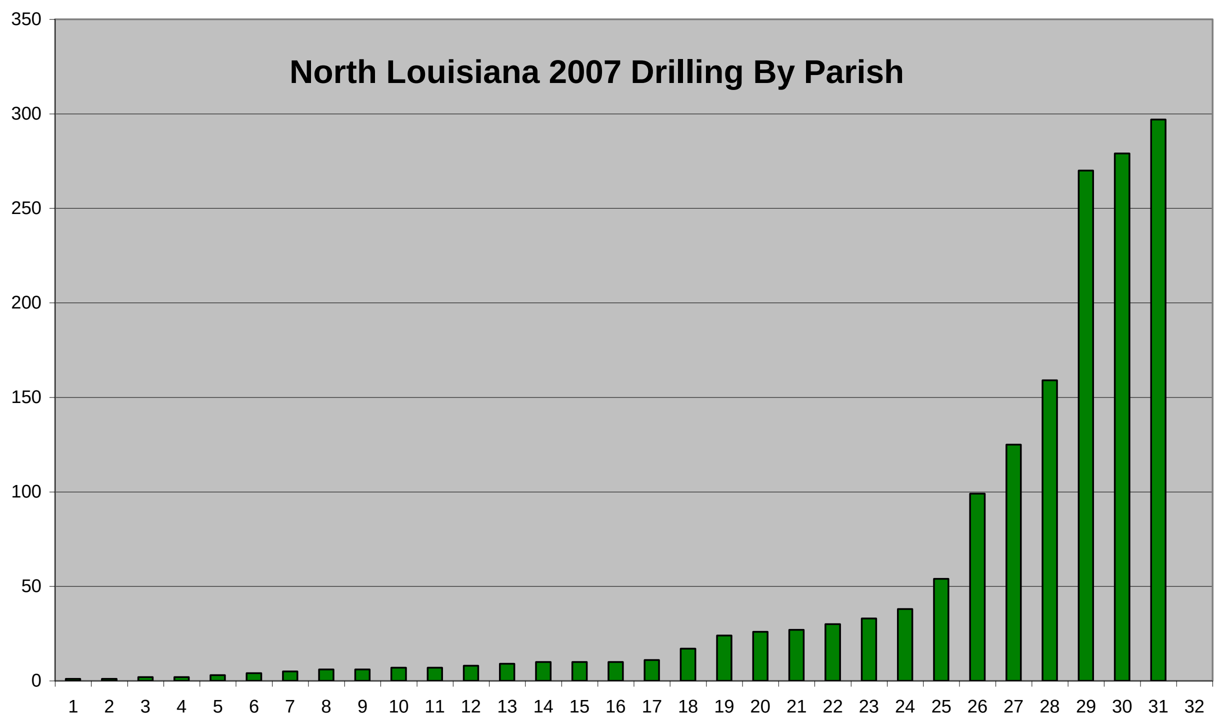
The southern portion of the state coincides with the Gulf Coast Salt Dome Basin; producing reservoirs are all Tertiary in age. Drilling in the Gulf Coast Salt Dome Basin is

Figure 10: New Wells in the North Louisiana Region by Year



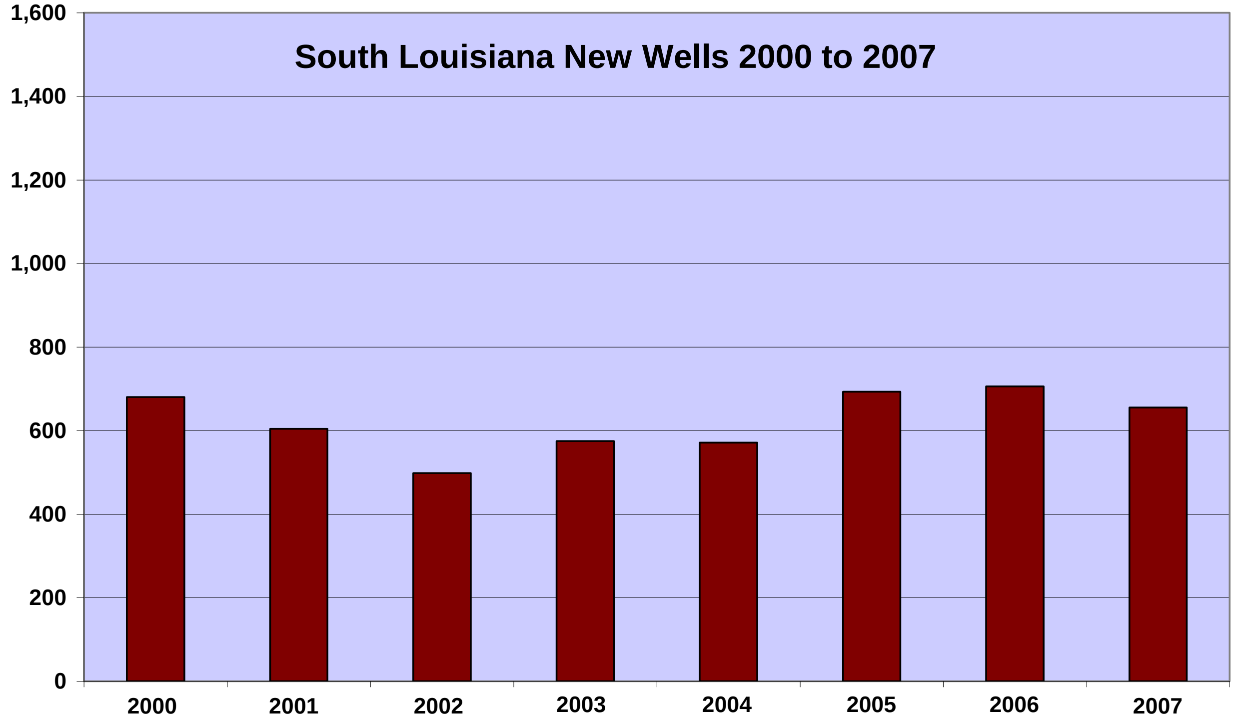
Source:
SONRISE Database 2008

Figure 11: 2007 New Wells in North Louisiana by Parish



Source: SONRISE Database 2008

Figure 12: New Wells in the South Louisiana Region by Year



Source: SONRISE Database 2008

historically slower in this region than in Northern Louisiana. The new well numbers shown in Figure 12 do not reflect the increases seen in product prices in the past eight years. In 2007 the number of new wells was less than half that in the northern portion of the state. Apparently the economics of new plays in this basin are not as attractive as are conventional and continuous resource plays in Northern Louisiana. This graph shows the relatively low level of drilling activity in the southern part of the state and the lack of response to the steep rise in product price since 2000.

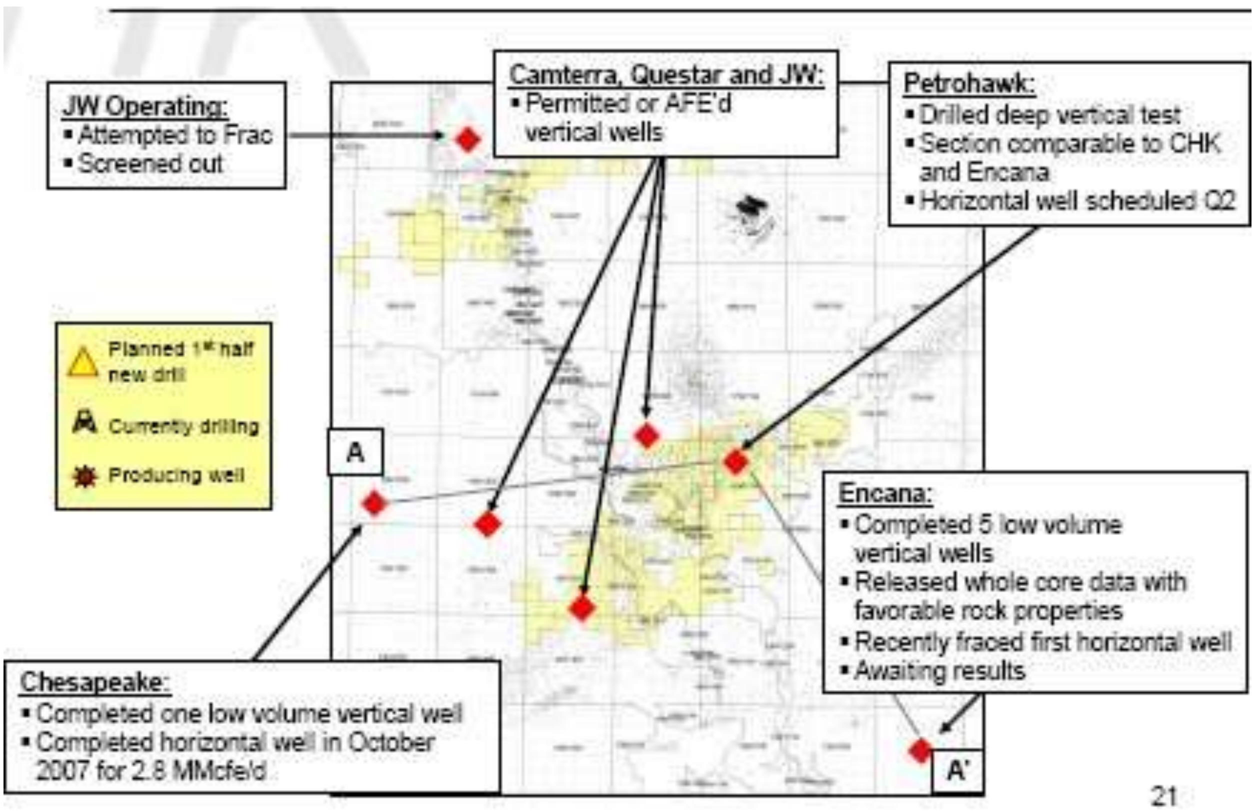
Because of this lack of response to product price, it can be assumed that no significant increases in the rate of drilling in the southern region will occur in the near future.

4.3 New Field and Reservoir Discoveries

A recent announcement has drawn attention to the Haynesville Shale, however very little information could be gathered about this play. However Chesapeake Energy Corporation described the Haynesville Shale in a recent news article as it related to the shale underlying their Elm Grove field as a rich, organic, shale below 10,000 feet and greater than 200 feet thick bounded by wells drilled by other operators, all with similar sections on logs. The area is much bigger than the Elm Grove field (see Figure 8). Based on its geoscientific, petrophysical and engineering research during the past two years and the results of three horizontal and four vertical wells it has drilled, Chesapeake believes the Haynesville Shale play could potentially have a very large amount of gas. Chesapeake is currently utilizing four rigs to drill Haynesville Shale wells and plans to increase its drilling activity level to approximately 10 rigs by year-end 2008 and potentially more in 2009. The company currently owns or has commitments for more than 200,000 net acres of leasehold in the Haynesville Shale and has a leasehold acquisition effort underway (see figure 13).

If one assumes 60 acre spacing and risk it by 50% that's results in over 1,650 drilling locations. Based on 500,000 acres that results in over 4,100 locations. If one further assume reserves of roughly 3 Bcfe per well (guesstimate) then one could calculate a net reserve addition potential in the range of 4 to 13+ Tcfe.

Figure 13: **Haynesville Shale Play**



Sources: http://www.istockanalyst.com/article/viewarticle.aspx?articleid=1637724)

5.0 OIL AND GAS ACTIVITY IN LOUISIANA

This section deals with the current status of oil and gas activity in Louisiana based on information provided by both public and private sources. Information includes; leasing activity, well spacing requirements, drilling and completion statistics by parish, Drilling practices, production statistics, oil and gas characteristics, oil and gas prices, operational costs (drilling, completion, and gathering and transmission), conflicts with other mineral development, and gas storage fields.

5.1 Leasing Activity

Leasing activity in Louisiana is on-going however based on the SONRIS dataset for inland lease sales (2000 – 2007) there appears to be no increase in activity that can be correlated to increased oil and gas prices. The data shows a peak in 2002 with 83,395 acres leased however the next year only 33,890 acres were acquired. This up and down pattern continues to today with 82,258 acres leased in 2006 followed by only 54,335 in 2007. Possible this is a result of reporting or the lack of private lease information being included in the dataset.

Recent announcements indicate that there has been considerable acquisitions ongoing over the past 12 months in the Haynesville shale play. Chesapeake currently owns or has commitments for more than 200,000 net acres of leasehold in the Haynesville Shale and has a leasehold acquisition effort underway with the goal of owning up to 500,000 net acres in the play (PennWell, 2008).

5.2 Well Spacing Requirements

Well spacing requirements for oil and gas wells drilled in Louisiana are subject to the rules and regulations of the Louisiana Department of Natural Resources (LDNR), State Mineral Board, Petroleum Lands Division.

The Petroleum Lands Division performs the mineral leasing function on behalf of the State Mineral Board, maintains state mineral lease ownership and property data, manages the docket of items submitted for Board consideration at its monthly meetings and maintains the official state mineral lease files.

The Division works closely with the Board's Tract Evaluation, Legal and Title Controversy and Docket Review Committees and its personnel provide the majority of public assistance at the public reference computer areas in the Baton Rouge office.

5.3 Drilling and Completion Statistics

Drilling rates vary between north and south Louisiana, for instance, the Northern Louisiana Region is the location of various low-permeability reservoirs such as the Jurassic and Lower Cretaceous carbonates and tite sands typified by the Cotton Valley.

Many of these reservoirs are exploited with long-reach horizontal wells. These wells are drilled using large rigs with a variety of other equipment onsite during drilling and completion, requiring a large drilling pad. On the other hand, these long-reach horizontals drain a large area from a single location. Some operators have found that drilling two wells from a common pad further cuts surface disturbances and drilling costs.

At the same time, Tertiary reservoirs in the Gulf Coast Salt Dome Basin of south Louisiana are often drilled directionally to avoid drilling into salt. As drilling moves south and approaches the coast, land becomes swampy and drill pads become difficult and expensive to drill. In those cases, several directional or horizontal wells are often drilled from one pad. This is the reason that Plaquimines Parish, at the mouth of the Mississippi River has the largest number of horizontal wells. The drilling forecasts that appear later in this report forecast the number of horizontal wells expected within each parish

5.4 Production Statistics

Figures 14 and 15 plot the production of oil and gas by the regions of the state in a historical sense. Most of the production curves show peak production around 1970 and steady decline since that year. The lone exception to that general trend is natural gas production from the northern portion of the state as shown in Figure 13. From a high point in 1964, gas rates declined until approximately 1978; from that point gas production has slowly increased up to the present day.

5.4.1 Crude Oil

Current oil and gas production activity mirrors drilling. Figure 16 ranks the parishes within the Northern Louisiana Region in terms of oil production in 2007. La Salle, Caddo, Claiborne, and Bossier Parishes have the highest rates of total oil production (crude oil plus condensate). These parishes all produced more than one million bbls of liquid hydrocarbons. Of the medium ranked parishes – Webster, East Baton Rouge, Pointe Coupee, and Lincoln – Webster and Lincoln are in the Cotton Valley play and the other two are adjacent to the Gulf Coast Salt Dome Basin.

Figure 17 plots the latest year's oil production for southern parishes and ranks those parishes. Those with the highest production are Plaquemines, LaFourche, and Terrebonne Parishes. Medium rates of oil production are from Cameron, St. Mary, Vermilion, Calcasieu, Iberia, and Jefferson Davis Parishes. Plaquemines Parish dominates production from the basin with most of its production being crude oil and condensate.

5.4.2 The oil rankings form the basis for predicting future drilling this portion of the state. Natural Gas

As with oil current gas production activity mirrors the drilling for natural gas. Figure 18 ranks the parishes within Northern Louisiana Region in terms of natural gas production in 2007. Bossier, De Sotto, Beinville and Jackson had the highest rates of total gas (natural gas plus casinghead gas) production in 2007. These four parishes each produced more than 60 BCF in the year. Of the medium-ranked parishes – Pointe Coupee, Caddo, Webster, Lincoln, Claibourne – Pointe Coupee is located new the Gulf Coast Salt Dome Basin and the others are all in the Cotton Valley play.

Figure 19 plots the latest year's gas production for southern parishes and ranks those parishes. High rates of gas production are Terrebonne, Plaquemines, Vermilion, and Cameron Parishes. Medium gas production is from Saint Mary, Iberia, and LaFourche Parishes.

Figure 14: Historic Oil Production by Region

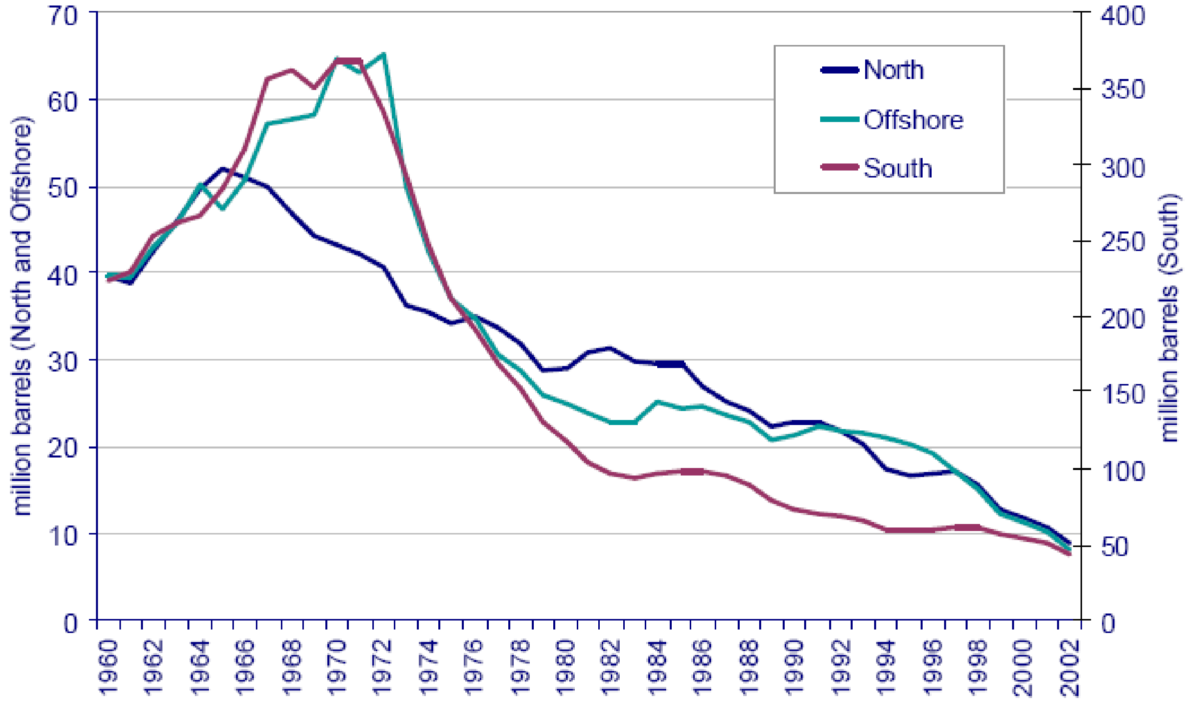


Figure 15: Historic Gas Production by Region

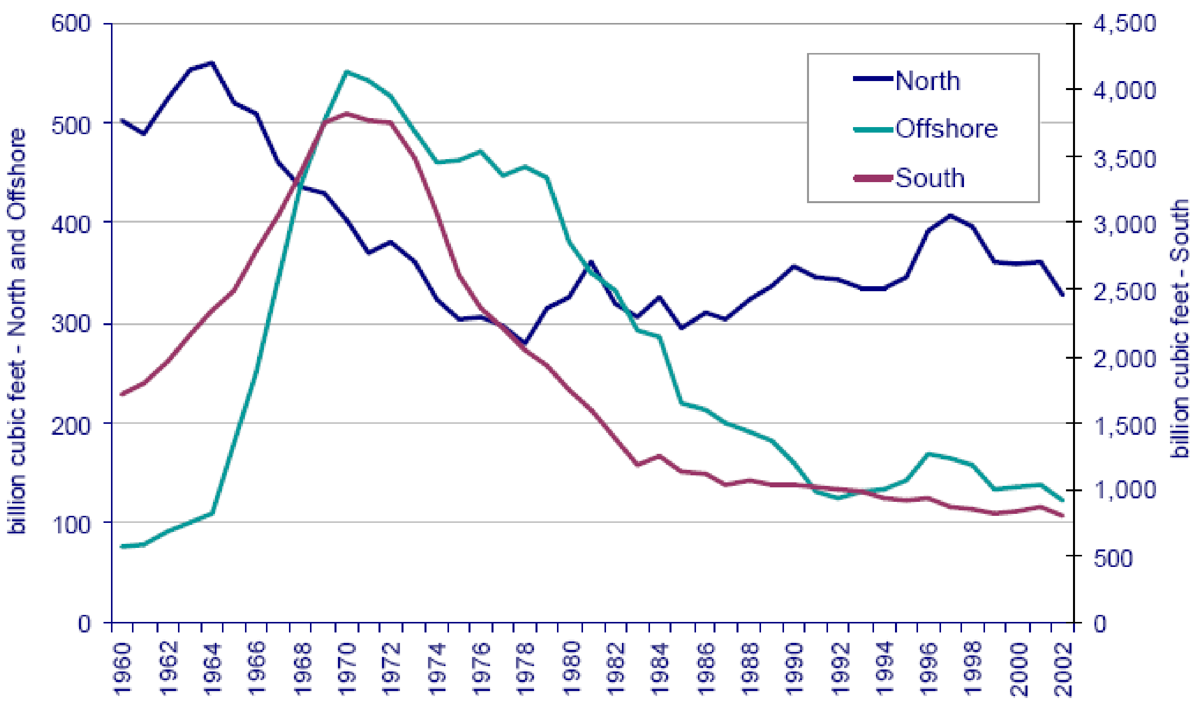


Figure 16: Low, Medium, and High Oil Producing Parishes

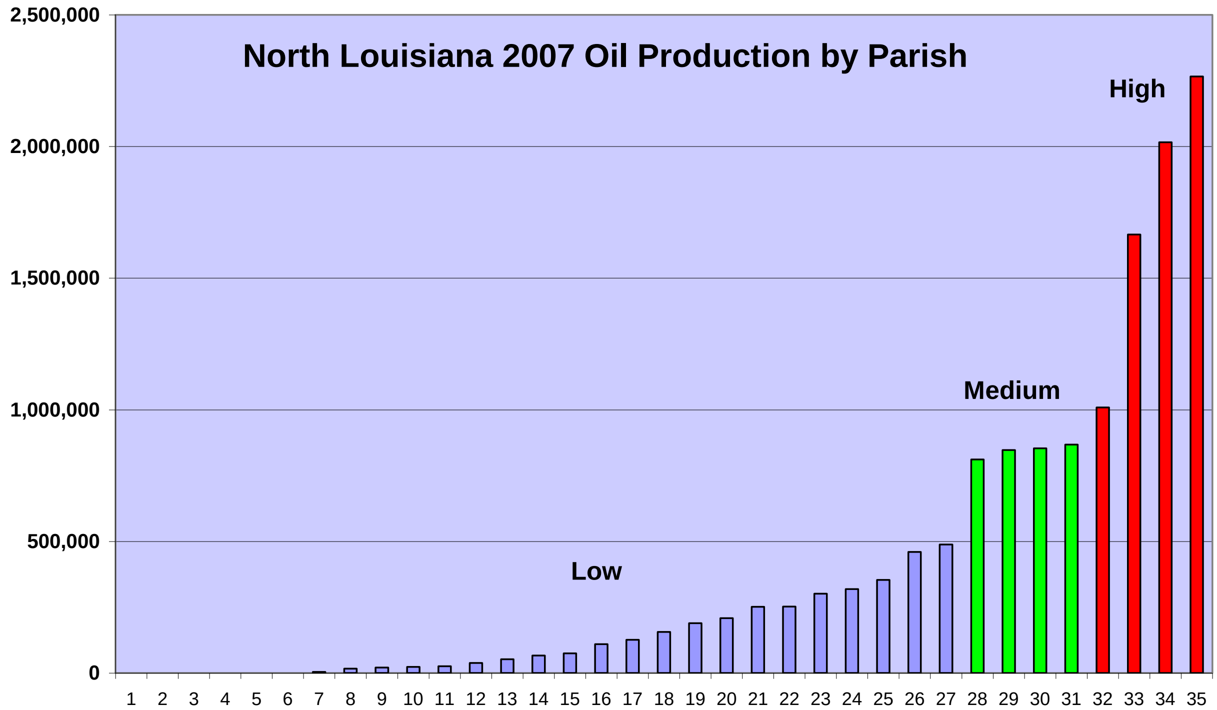
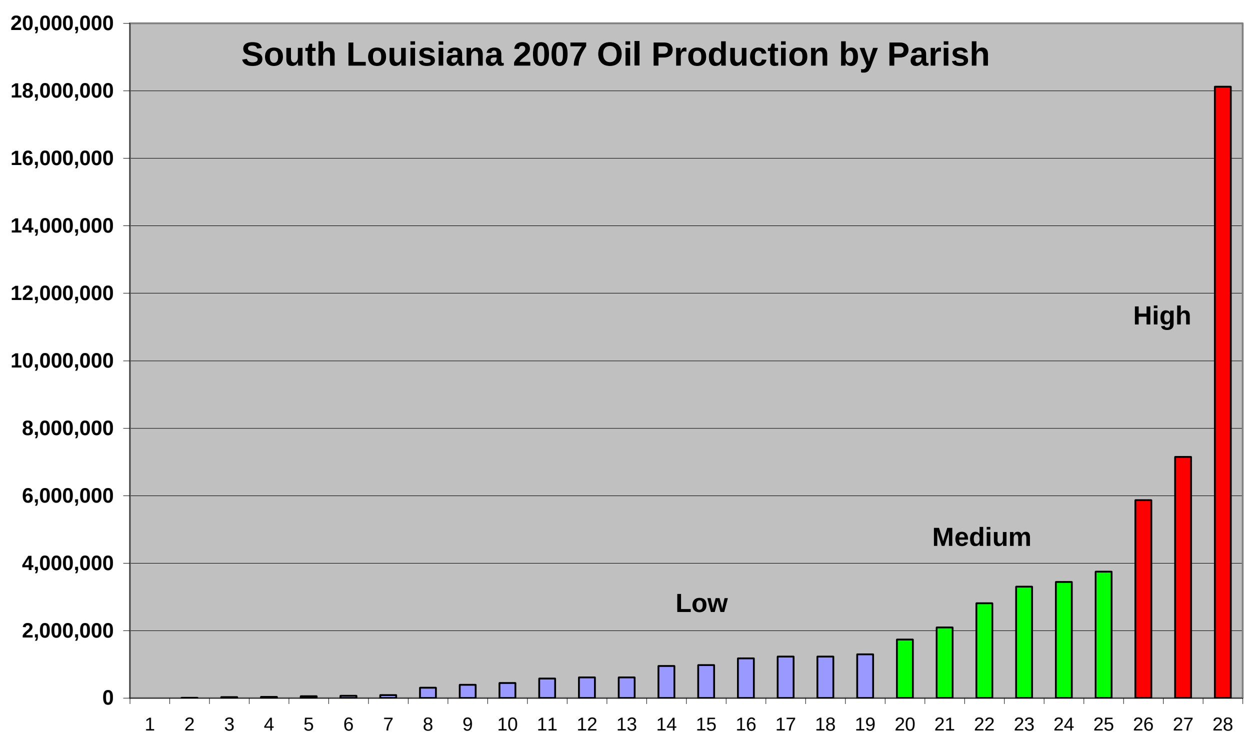


Figure 17: Parishes Ranked by Oil Production



5.5 Oil and Natural Gas Characteristics

5.5.1 Natural Gas

Most gas recovered from fields in northern Louisiana is considered to be a wet gas as it contains some of the heavier fluid hydrocarbons. In contrast to dry gas that does not carry appreciable amounts of the heavier hydrocarbons as vapor.

5.5.2 Crude Oil

Crude oil is generally characterized by the oil's gravity and the presence or absence of any contaminates that may ultimately affect or limit the use of that crude oil in refinery operations. The standard gravity measurement is termed the API (American Petroleum Institute) gravity. API gravity is defined as: (141.5 ÷ SG) - 131.5 where SG is specific gravity at 60 degrees Fahrenheit (Schlumberger, web). Crude oils are generally termed light or heavy crudes based on the API gravity. A light crude oil is generally one with an API gravity over 40, while very heavy crude oils will typically have an API gravity of 20 or less - the higher the API gravity, the lower the density of the crude oil.

An important contaminant for crude oils in northern Louisiana is the sulfur H_2S. When the sulfur content of a crude oil exceeds .5 percent the crude is considered a "sour" crude.

Crude oil produced in the southern part of Louisiana has a wide variety of API gravity ratings. These rating vary by depth, producing reservoir, and geographic location. A review of SONRIS data for oil fields located in that part of the state show API gravities ranging from a low of 11 degrees to a high of 72 degrees. In individual productive fields the API gravity for a single formation may vary as much as 34 degrees based on its position in the field (SONRIS, 2007).

Recent pricing bulletins, December, 2007, for northern Louisiana require API gravity rating in the range of 34 to 44.9 degrees to receive the pricing reserved for what is termed "South Arkansas and North Louisiana Sour". Any decrease or increase above that range results in a net reduction of $.015 / bbl in the price paid per barrel.

Figure 18: Low, Medium and High Gas Producing Parishes

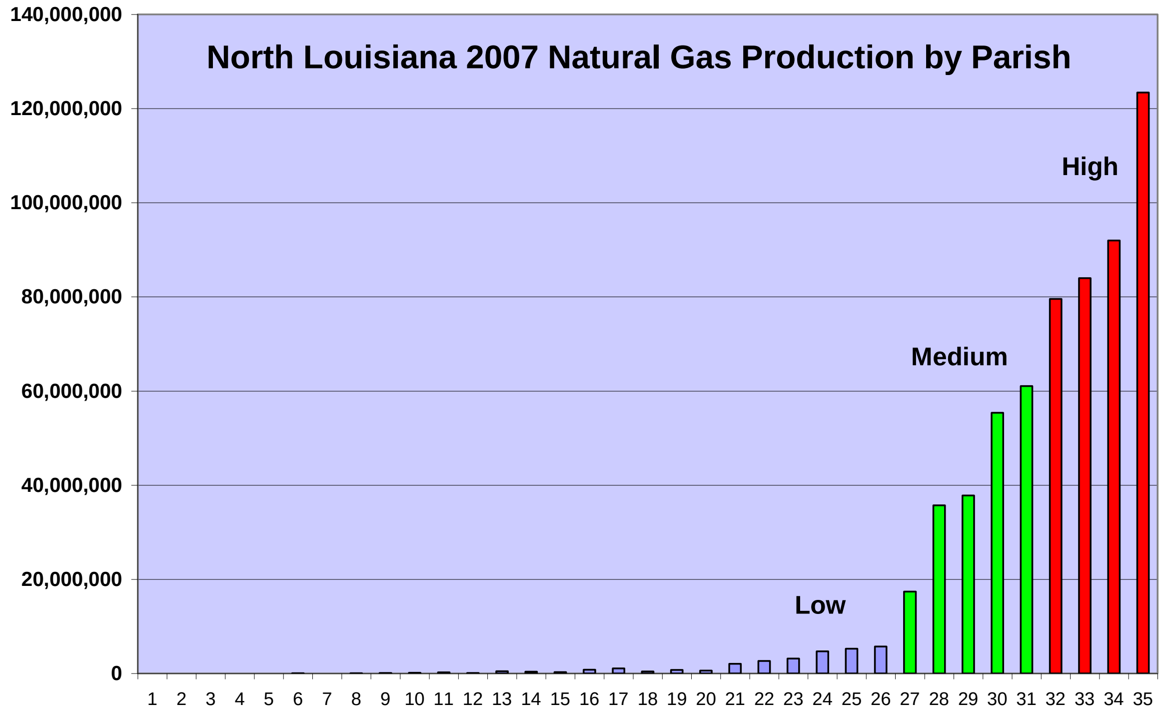
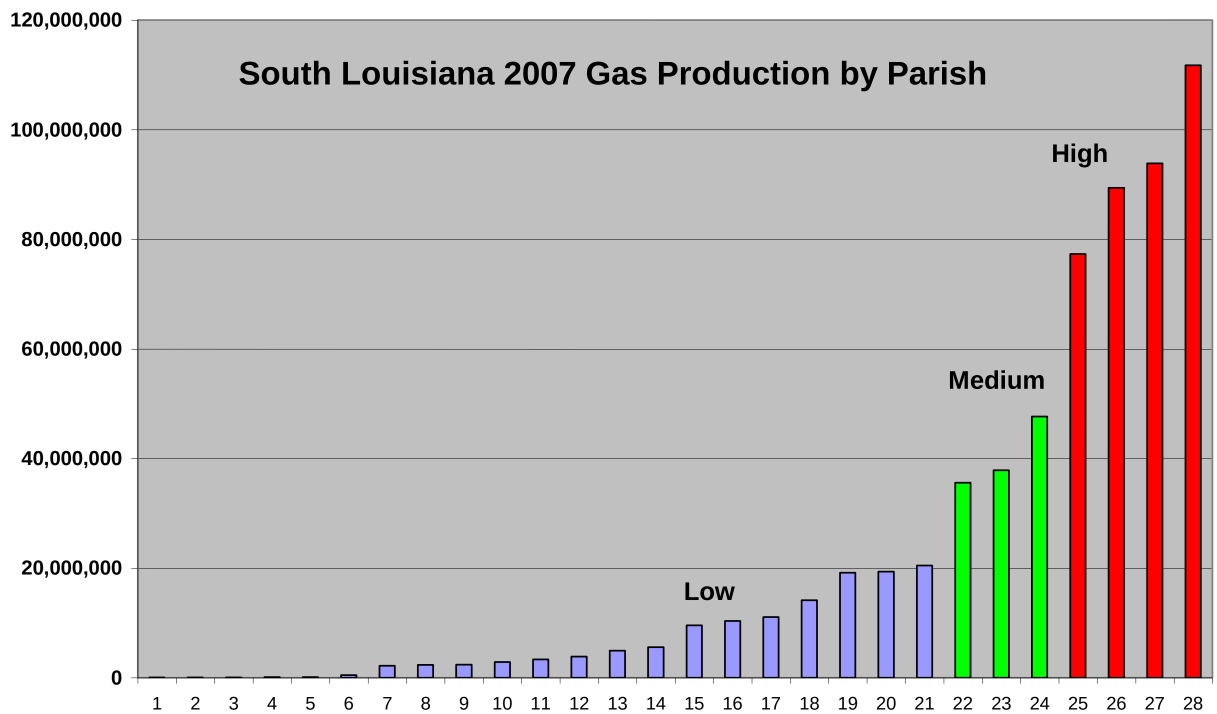


Figure 19: Parishes Ranked by Gas Production



5.6 Oil and Gas Prices

Oil and gas have been produced in the state since 1901. Oil and gas have been and remain important economic drivers for the citizens of the state. New wells have been drilled since 1901 in response to economics, largely determined by the commodity price of crude oil and natural gas (Figure 20). Price of crude oil first climbs out of historically low prices in 1973, reaching a peak in 1980. The price then fell and remained low until 2000 when price again began to increase to its current high levels. It is this last increase in price that is driving current and expected future drilling activity in the state.

As can be seen from a review of the graph in Figure 21 the annual average wellhead price for Louisiana natural gas reported by first purchasers has steadily risen from $4.50/Mcf in 2000 to $7.30/Mcf in 2007 (EIA, web).

Both crude oil and natural gas prices are generally expected to remain strong for the foreseeable future.

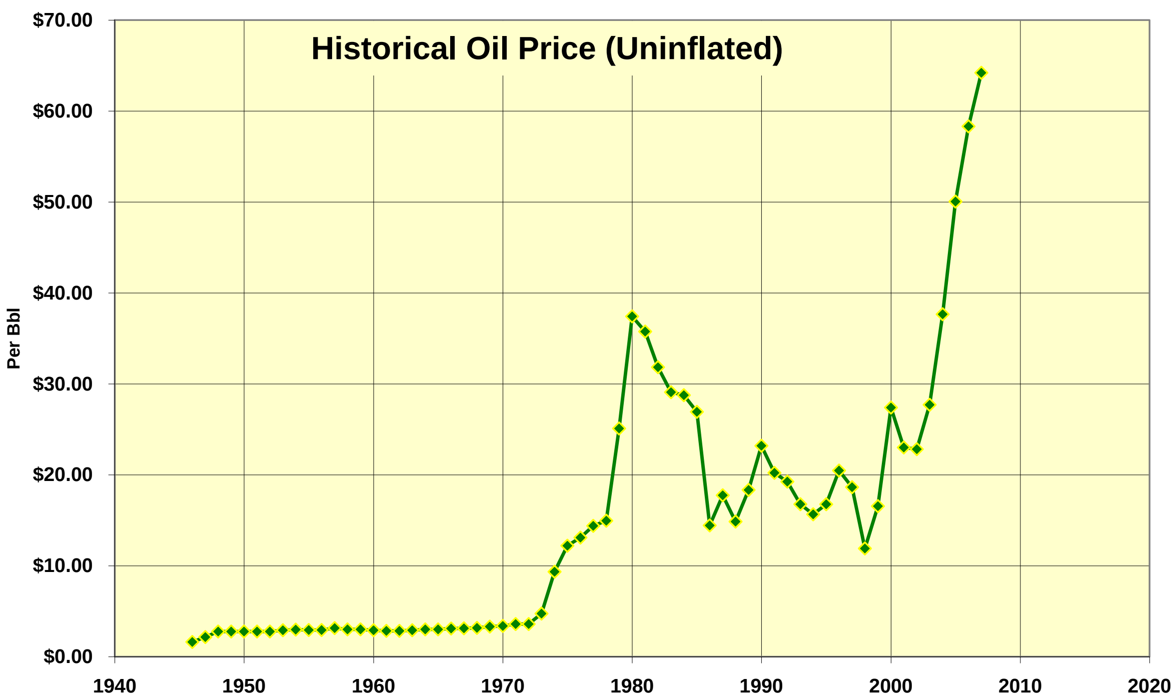
5.7 Conflicts with Other Mineral Development

Mineral development in Louisiana is extensive and almost exclusively involves the production of oil and gas. Based on interviews with personnel from the State Mineral Board there appears to be no conflicts between oil and gas operations and on-going mineral development (Badeaux 2008)

5.8 Gas Storage Fields

EIA gas storage data for 2006 indicates that there are 14 active gas storage fields operating in the State of Louisiana with a total capacity of 599,165 MMcf (EIA website, Natural Gas Storage, Form EIA-191 Data, 2008). The fields consist of six salt caverns (68,739 MMcf) and eight depleted gas fields (530,426 MMcf) that have been converted to gas storage operations. Details with respect to the operator, field name, reservoir, type, total field capacity, and authorized maximum daily delivery for those fields are provided in Table 2.

Figure 20: Historic Oil Prices



Source: Illinois Oil and Gas Association, 2008

Figure 21: Natural Gas Prices 2000- 2007

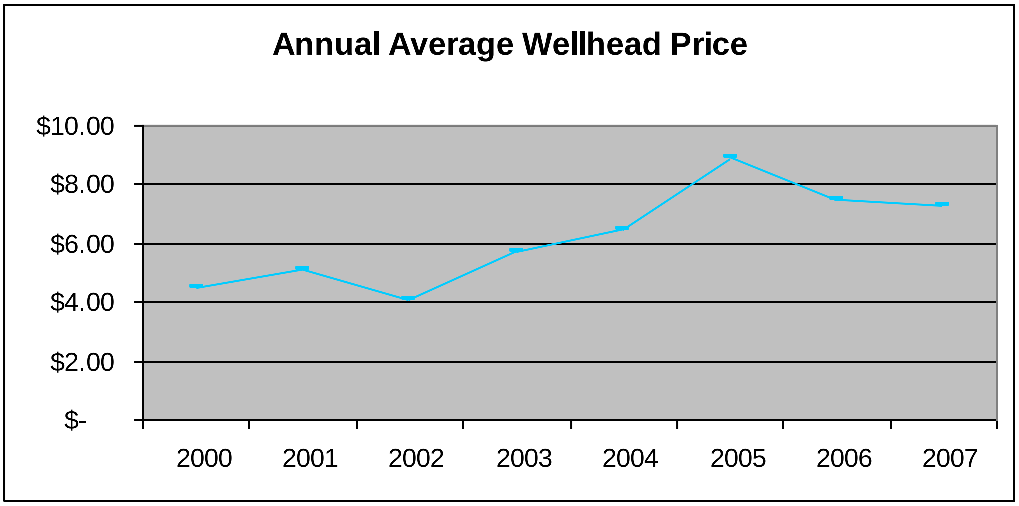


Table 2: Active Gas Storage Fields in Arkansas

Operator	Field Name	Reservoir	Field Type	Total Field Capacity (Mcf) (2006)	Maximum Daily Delivery (Mcf) (2006)
Bear Creek Storage Company	Bear Creek	Pettit	Depleted Field	114,900,000	900,000
Bridgeline Gas Distribution	Sorrento	Underground Storage Dome #1 & #2	Salt Dome	11,333,045	240,000
Bridgeline Storage Co, LLC	Napoleonville Ns-1	Napoleonville Ns-1	Salt Dome	10,966,000	400,000
Centerpoint Energy Gas Transmission	Ruston	James	Depleted Field	5,700,000	75,000
Egan Hub Partners, L.P.	Egan Storage Dome	N A	Salt Dome	25,662,700	1,500,000
Gulf South Pipeline Company	Bistineau Gas Storage	Pettit	Depleted Field	141,000,000	1,200,000
Gulf South Pipeline Company	Magnolia Gas Storage	Salt Dome	Salt Dome	8,000,000	
Jefferson Island Storage and Hub LLC	Jefferson Island Storage & Hub LLC	American Electric Power State Lease	Salt Dome	10,000,000	800,000
Mississippi River Transmission Corp	West Unionville	Vaughn	Depleted Field	27,100,000	270,000
Mississippi River Transmission Corp	East Unionville	Vaughn	Depleted Field	55,200,000	435,000
Pontchartrain Natural Gas System	Grand Bayou		Salt Dome	2,777,151	225,310
Transcontinental Gas Pipeline Corp.	Hester	Discorbis "d-2" Sand	Depleted Field	23,526,307	102,000
Transcontinental Gas Pipeline Corp.	Washington	Cockfield "d" Sand	Depleted Field	120,000,098	882,355
Trunkline Gas Company	Epps	Monroe Gas Rock	Depleted Field	43,000,000	150,000
TOTALS				599,165,301	7,179,665

Source: (EIA website, Natural Gas Storage, Form EIA-191 Data, 2007

6.0 OIL AND GAS OCCURRENCE POTENTIAL

6.1 Existing oil and gas production

Oil and gas has been produced in Louisiana for many years. Sixteen parishes have current production of natural gas while seventeen parishes have existing oil production.

The northern portion of the state produces natural gas with only a small amount of crude oil and condensate; La Salle Parish is the only parish in the northern portion of the state that is dominated by oil. The southern region of the state is dominated by oil production although associated natural gas is also produced. The parishes are ranked by production as diagramed in figures 22 and 23.

Drilling activity records are maintained by the state of Louisiana Department of Natural Resources. Drilling activity as presented in tables 3 & 4 is composed of active producing wells and dry and abandoned wells; undrilled permits and shut-in wells are not considered since their actual disposition is as yet unknown. Horizontal wells are summarized by the LDNR by effective date. Those horizontal wells finalized in 2007 may have been wells newly drilled in that year but will also include wells that have been drilled in previous years that have been re-entered and re-drilled with a horizontal segment. Horizontals were treated as separate from producing wells in order to reflect that fact.

Figure 22: Ranking of Natural Gas Occurrence in Louisiana

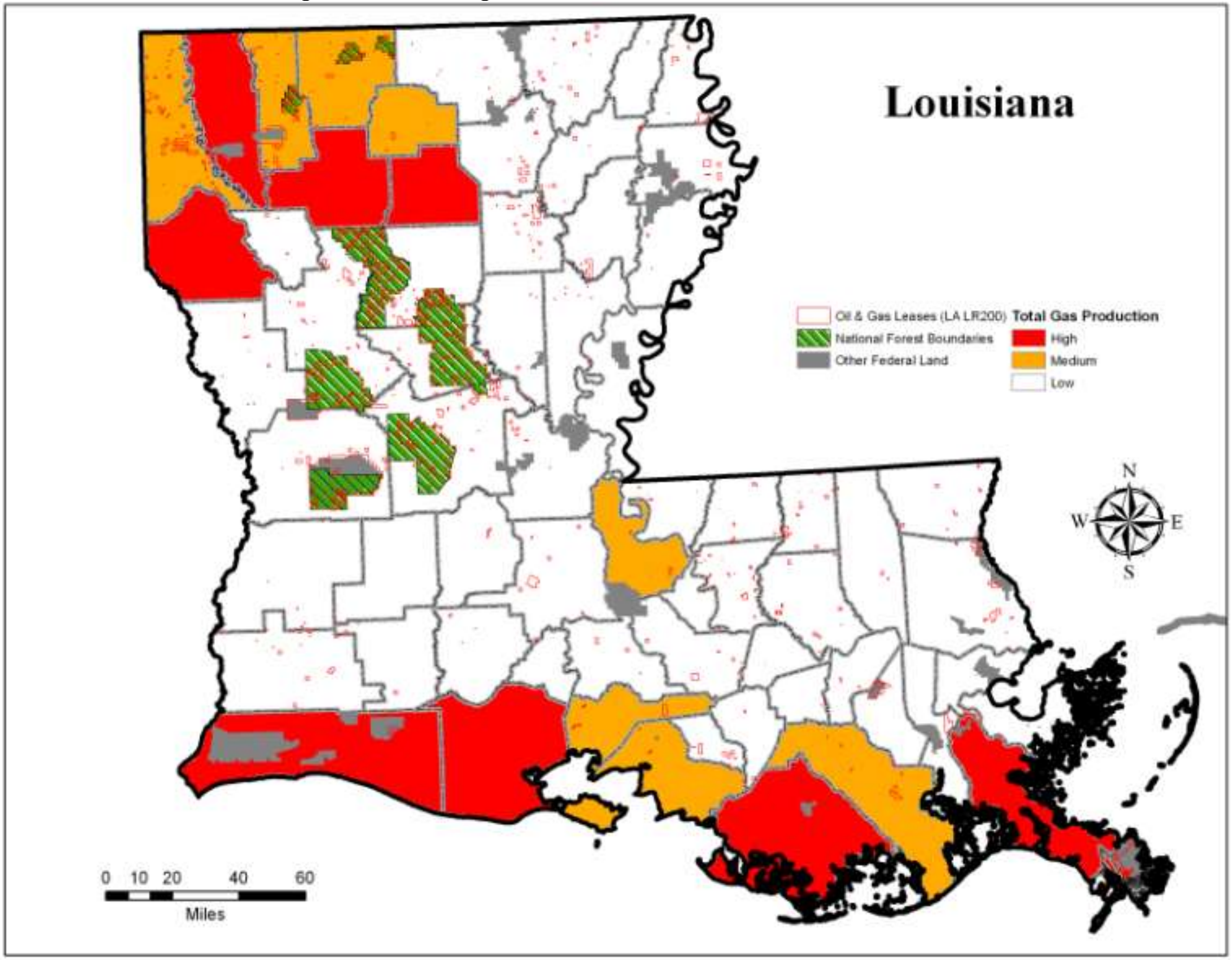


Figure 23: Ranking of Crude Oil Occurrence in Louisiana

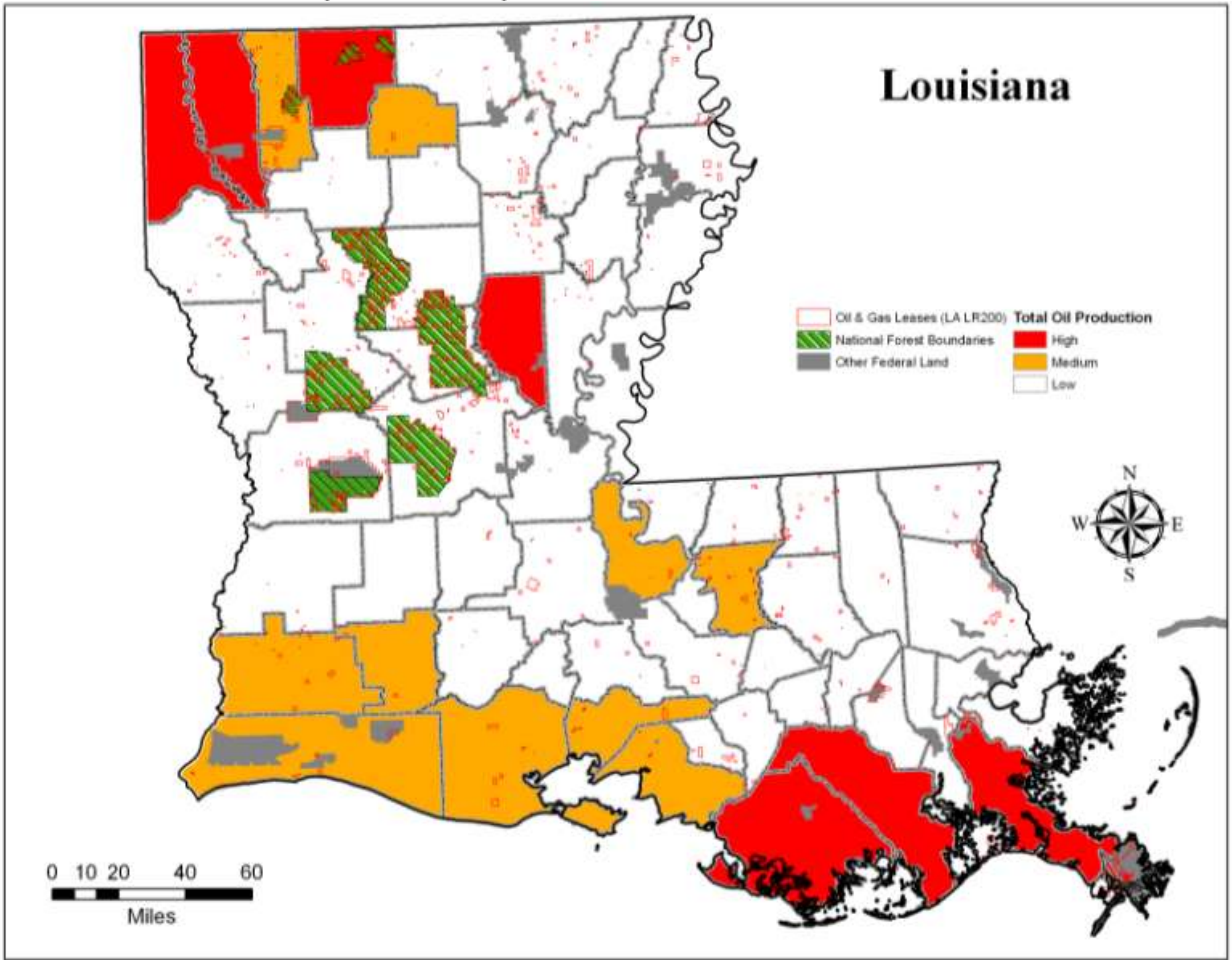


Table 3: Northern Parishes Production Wells and Ranking

PARISH	Oil Rank	2007 Production Wells	2007[1] Horizontal Wells	2007 Dry Holes	2000-2007 Total Production Wells	2000-2007 Average Production Wells
Bossier	High	170	76	11	1,106	138.3
De Sotto	High	166	54	0	1,058	132.3
Beinville	High	111	5	3	470	58.8
Jackson	High	14	103	1	365	45.6
Pointe-Coupee	Medium	5	4	1	34	4.3
Caddo	Medium	135	26	8	918	114.8
Webster	Medium	27	10	0	251	31.4
Lincoln	Medium	80	7	1	242	30.3
Claiborne	Medium	16	0	2	167	20.9
Union	Low	4	0	2	-	-
East Baton Rouge	Low	5	0	2	-	-
Quachita	Low	4	0	3	-	-
Sabine	Low	12	27	6	-	-
Caldwell	Low	16	1	1	-	-
Red River	Low	7	11	0	-	-
Rapides	Low	3	13	3	-	-
La Salle	Low	36	1	30	-	-
Vernon	Low	1	2	3	-	-
Livingston	Low	0	3	1	-	-
Morehouse	Low	1	0	0	-	-
Tensas	Low	2	1	1	-	-
Natchitoches	Low	0	2	2	-	-
Winn	Low	9	0	6	-	-
Concordia	Low	5	0	7	-	-
East Feliciana	Low	0	1	0	-	-
Washington	Low	0	0	0	-	-
Avoyelles	Low	0	2	4	-	-
Catahoula	Low	6	0	4	-	-
Saint Helena	Low	0	0	1	-	-
Grant	Low	0	0	0	-	-
Franklin	Low	1	0	2	-	-
Madison	Low	1	0	0	-	-
West Carroll	Low	0	0	0	-	-
Saint Tammany	Low	0	0	0	-	-
Tan Gipahoa	Low	0	0	0	-	-
TOTALS		**837**	**349**	**105**	**4,611**	**576.7**

[1]These wells have an effective date of 2007 but may have been originally drilled earlier and re-completed as horizontals

Table 4: Southern Parishes Production Wells and Ranking

PARISH	Oil Rank	2007 Production Wells	2007 Horizontal Wells	2007 Dry Holes	2000-2007 Total Production Wells	2000-2007 Average Production Wells
Plaquemines	High	31	331	5	349	43.6
LaFourche	High	20	82	5	139	17.4
Terrebonne	High	20	98	7	218	27.3
Cameron	Medium	22	62	5	116	14.5
Saint Mary	Medium	21	63	7	144	18.0
Vermilion	Medium	9	38	13	102	12.8
Calcasieu	Medium	19	53	10	125	15.6
Iberia	Medium	4	27	3	63	7.9
Jefferson Davis	Medium	6	9	4	82	10.3
Acadia	Low	5	29	5	-	-
Saint Martin	Low	1	52	0	-	-
Jefferson	Low	5	23	2	-	-
Evangeline	Low	7	9	0	-	-
Iberville	Low	3	17	4	-	-
Beauregard	Low	11	10	2	-	-
Saint Charles	Low	0	11	1	-	-
Lafayette	Low	0	0	0	-	-
Saint Bernard	Low	2	22	4	-	-
Saint Landry	Low	2	5	3	-	-
Assumption	Low	0	8	0	-	-
Allen	Low	3	25	3	-	-
Saint James	Low	0	9	1	-	-
West Baton Rouge	Low	2	0	0	-	-
Ascension	Low	0	8	0	-	-
St. John the Baptist	Low	0	0	1	-	-
Richland	Low	0	0	0	-	-
West Feliciana	Low	0	0	0	-	-
Orleans	Low	0	0	0	-	-
TOTALS		**193**	**991**	**85**	**1,338**	**167.4**

7.0 OIL AND GAS DEVELOPMENT POTENTIAL

7.1 Relative Oil and Gas Development Potential

Parishes are ranked in the previous section according to current production and drilling activity. Many of these parishes have seen increased oil and gas activity since approximately 2002, driven by increases in crude oil price. It is expected that the current historical high price for oil (between $90 and $100 per bbl) will continue into the future or increase to some extent. If, on the other hand, crude oil prices were to slip downward, drilling rates would likely be reduced.

It is expected that the parishes labeled as high-rank will show continued increases in development and in drilling. Medium rank and low rank parishes (Tables 6 & 8) are expected to see a small number of wells drilled each year but show little or no increase in the rate of drilling.

The future potential for oil and gas can be estimated from current levels of activity for the various parishes in Louisiana. It is best to rank the natural gas-prone northern parishes from the oil-prone southern parishes.

7.1.1 Northern Louisiana Region

The latest USGS resource assessment was used to develop a summary list of Northern Louisiana plays (Table 5). Approximate locations are given in relation to the major structural elements in Figure 2. Potential is estimated from low to high. These plays vary from deep to shallow and are scattered over the region. Few of these plays are new and it is not believed that any of them will overwhelm the drilling trends exhibited in the past eight years. It is expected that drilling activity across the region will be similar to 2007 in terms of number of wells, locations of the wells (located by parish), drilling depth, and drilling methodology.

Drilling activity forecast is shown in Table 6; the forecast value for annual wells during the next ten years is taken from drilling activity in 2007 or the average from 2000 to 2007, whichever is greater (Table 3). The number of wells shown in Table 6 is split between general federal ownership, US Forest Service, and state plus fee land on the basis of the percentage of ownership in the parish. Since we do not know where in each parish future drilling will happen, we can assume a random distribution. The range of forecast drilling is as high as 170 producing wells and 11 dry holes on an annual basis (Bossier Parish) or a northern region-wide total of 878 producing wells and 113 dry holes per year. On the other hand, several parishes are forecast to have no drilling during the next ten years.

7.1.2 Southern Louisiana Region

The southern region of the state is dominated by oil production although associated natural gas is also produced. Oil and gas plays within the Southern Onshore region are described by the USGS in Table 7. These plays involve sands of Paleocene (Wilcox) to Lower Miocene age. Traps are mostly structural while sources and traps are mostly internal mudstones adjacent to the sands. Plays are all discrete, involving small areas where favorable structures, reservoirs, and traps combine to optimize production. Unconventional, continuous reservoirs have not been seen and are not expected to be present in the basin.

Drilling activity has been down in this portion of the state for a number of years and this is expected to continue as is reflected in the forecast activity (Table 8). The busiest parish (Plaquemines) is predicted to hold 31 producing wells and five dry holes per year while this portion of the state is predicted to see 212 producing wells and 85 dry holes for each of the next ten years.

Forecast totals for the two regions of the state are summarized in Table 9 by well type and mineral ownership.

Table 5: Potential Play Statistics in the Northern Louisiana Region

Play	Reservoir	Trap/Seal	Source Rock	Potential
Conventional Oil and Gas Plays				
4912 Smackover Salt Basins	Smackover carbonates	Structural Traps, sealed by overlying Haynesville	Smackover and Haynesville	High
4915 No. Louisiana Smackover Grey Sandstone	Upper Smackover/Buckner Grey Sandstone	Structural Traps, sealed by overlying internal shales	Equivalent shales and Haynesville	High
4918 Haynesville Salt Basins	Marine sands in the Haynesville	Structural traps, sealed by Haynesville shales	Haynesville	High
4921 Cotton Valley Updip Oil	Detaic sands of the Cotton Valley	Structural traps, sealed by Cotton Valley shales	Haynesville and Smackover	Low to Moderate
4922 Cotton Valley Salt Basins Gas	Deltaic and marine sands in the Cotton Valley	Structural and stratigraphic traps, sealed by Cotton Valley shales	Haynesville and Smackover	High
4924 Cotton Valley Sabine Uplift Gas	Deltaic and marine sands in the Cotton Valley	Structural traps, sealed by Cotton Valley shales	Haynesville and Smackover	Low to Moderate
4927 Travis Peak Sabine Uplift	Travis Peak deltaic and marine sands	Structural and stratigraphic traps, sealed by Travis Peak shales	Haynesville and Smackover	Moderate to High
4929 Sligo/Pettet Salt Basins Gas	Sligo sands and Pettet carbonates	Structural and stratigraphic traps, sealed by Glen Rose evaporites	Unknown	Moderate to High
4930 Pettet Southern Sabine Uplift	Pettet carbonates	Structural traps, sealed by Glen Rose evaporites	Unknown	Moderate
4931 James Limestone Gas	James Carbonates	Structural traps, sealed by Glen Rose evaporites	Lower Cretaceous shales	Moderate to High
4932/4933 Glen Rose/Rodessa	Delataic sands in the Glen Rose and Rodessa	Structural and stratigraphic traps, sealed by evaporites	Lower Cretaceous shales	Moderate to High
4934/4935 Paluxy Oil and Gas	Deltaic sands of the Paluxy/Washita-Fredricksburg	Structural traps sealed by Lower Cretaceous shales	Lower Cretaceous shales	Moderate
4937 Tuscaloosa/Woodbine Structural	Deltaic sands of the Tuscaloosa/Woodbine	Structural and stratigraphic traps, sealed by internal shales	Eagleford Shale	Low to Moderate
4938 Tuscaloosa Stratigraphic oil and gas	Fluvial sands of the Tuscaloosa	Stratigraphic traps sealed by internal shales	Internal shales	Low to High
4941 Eutah Southern Salt Basins	Marine sands of the Eutah and Tokio	Structural traps, sealed by Upper Cretaceous shales	Upper Cretaceous shales	High
4942 Austin Chalk	Chalk in the Austin	Structural traps sealed by internal mudstones	Eagleford Shale	Moderate
4945 Wilcox Salt Basins	Deltaic sands of the Wilcox, Frio, and Sparta	Structural and stratigraphic traps, sealed by internal mudstones	Internal shales and mudstones	Moderate
4946 Wilcox Northern Louisiana Salt Basin gas	Deltaic sands of the Wilcox	Structural and stratigraphic traps, sealed by internal mudstones	Smackover/Haynesville shales	Low
Unconventional Plays				
4923 Cotton Valley Continuous Sands (Includes both Blanket and massive sand plays)	Deltaic sands of the Cotton Valley	Structural traps sealed by internal shales	Smackover/Haynesville shales	High
Haynesville Gas-Shale	Thick, bituminous shales of the Haynesville	Structural traps sealed by internal shales	Haynesville shale	High

Sources: USGS, 1995 and USGS, 2006

Table 6: Northern Louisiana Annual Drilling Activity Forecast

PARISH	Forecast of Total Annual[1] Production Wells			Forecast of Total annual State & Fee Production Wells			Non-USFS		Forecast Annual Federal Production Wells
	Vertical	Horizontal	Dry Holes	Vertical	Horizontal	Dry Holes	Acres	Percent	
Bossier	170	76	11	162	73	10	25,754	4.6	8
De Sotto	166	54	2	166	54	2	0	0	0
Beinville	111	5	3	111	5	3	0	0	0
Jackson	46	30	1	46	30	1	0	0	0
Pointe-Coupee	5	4	1	5	4	1	18,630	4.9	0
Caddo	135	26	8	135	26	8	0	0	0
Webster	31	10	0	29	10	0	12,484	3.2	1
Lincoln	80	7	1	80	7	1	0	0	0
Claiborne	21	0	2	20	0	2	0	0	0
Union	4	0	2	4	0	2	39,031	6.8	0
East Baton Rouge	5	0	2	5	0	2	0	0	0
Quachita	4	0	3	4	0	3	12,955	3.2	0
Sabine	12	10	6	12	10	6	10,155	1.6	0
Caldwell	16	1	1	16	1	1	0	0	0
Red River	7	6	0	7	6	0	0	0	0
Rapides	3	2	3	3	2	3	6,065	0.7	0
La Salle	36	1	36	35	1	35	6,405	1.5	1
Vernon	1	2	3	1	2	3	94,791	10.9	0
Livingston	0	1	1	0	0	1	0	0	0
Morehouse	1	0	0	1	0	1	6,111	1.2	0
Tensas	2	1	1	2	1	1	18,780	4.5	0
Natchitoches	0	2	2	0	2	2	4,789	0.6	0
Winn	9	0	6	7	0	5	0	0	0
Concordia	5	0	7	5	0	7	19,926	4.2	0
East Feliciana	0	1	0	0	1	0	0	0	0
Washington	0	0	0	0	0	0	952	0.2	0
Avoyelles	0	2	4	0	2	4	49,820	9.0	0
Catahoula	6	0	4	6	0	4	2,239	0.5	0
Saint Helena	0	0	1	0	0	1	0	0	0
Grant	0	0	0	0	0	0	0	0	0
Franklin	1	0	2	1	0	2	0	0	0
Madison	1	0	0	1	0	0	60,999	15.2	0
West Carroll	0	0	0	0	0	0	1,460	0.6	0
Saint Tammany	0	0	0	0	0	0	42,175	7.8	0
Tan Gipahoa	0	0	0	0	0	0	0	0	0
TOTALS	**878**	**241**	**113**	**864**	**237**	**111**	**433,521**	**-**	**10**

1 - Forecasted annual gas wells represent all mineral owners, state, fee, and federal.

Table 7: Potential Play Statistics in the Southern Louisiana Region

Play	Reservoir	Trap/Seal	Source Rock	Potential
Conventional Oil and Gas Plays				
4719 Lower Wilcox Fluvial Oil and Gas	Fluvial/deltaic sands of the Wilcox	Structural and stratigraphic traps, sealed by internal mudstones	Wilcox shales and mudstones	High
4720 Lower Wilcox Downdip Overpressured Gas	Marine Slope sands of the Wilcox	Structural traps, sealed by internal mudstones	Wilcox shales and mudstones	Very High
4722 Upper Wilcox Shelf-edge Sands	Marine sands of the Wilcox	Structural and structural-stratigraphic traps, sealed by internal mudstones	Wilcox shales and mudstones	High
4723 Upper Wilcox Down-dip Overpressured Gas	Marine Slope sands of the Upper Wilcox	Structural traps, sealed by internal mudstones	Upper Wilcox shales and mudstones	Very high
4724 Middle Eocene Down-dip Gas	Claiborne/Yegua Sands	Structural traps, sealed by internal mudstones	Claiborne/Yegua Mudstones	High
4725 Middle Eoccene Up-dip Sands	Claiborne/Yegua Sands	Structural traps, sealed by internal mudstones	Claiborne/Yegua Mudstones	Low to Moderate
4728 Jackson Up-dip sands	Deltaic and shelf Jackson sands	Structural and stratigraphic traps, sealed by internal mudstones	Jackson mudstones	Moderate
4729 Jackson Down-dip Gas (Hypothetical)	Jackson Slope sands	Structural and stratigraphic traps, sealed by internal mudstones	Jackson mudstones	Very high
4730 Vicksburg Up-dip Gas	Fluvial Sands of the Vicksburg	Structural and stratigraphic traps, sealed by internal mudstones	Vicksburg mudstones	Low to Moderate
4731 Vicksburg Down-dip Gas	Marine sands of the Vicksburg	Structural and stratigraphic traps, sealed by internal mudstones	Unknown	Very high
4734 Frio Up-dip Sands	Fluvial and coastal plain sands of the Frio	Structural and stratigraphic traps, sealed by internal mudstones	Frio mudstones	Moderate
4735 Frio Mid-dip Sands	Deltaic and marine shelf sands of the Frio	Structural traps, sealed by internal mudstones	Frio mudstones	Moderate to High
4736 Frio Down-dip Gas Sands	Shelf and slope sands of the Frio	Structural and stratigraphic traps, sealed by internal mudstones	Frio mudstones	High
4738 Anahuac Sand	Deltaic to slope sands of the Anahuac	Structural traps, sealed by internal mudstones	Anahuac mudstones	Moderate
4740 Lower Miocene deltaic Sands	Deltaic sands of the Lower Miocene	Structural traps, sealed by internal mudstones	Lower Miocene mudstones	Moderate to High
4741 Lower Miocene Slope and Fan sands	Deep water sands of Lower Miocene age	Structural and stratigraphic traps, sealed by internal mudstones, some are overpressured	Lower Miocene mudstones	High

Table 8: Southern Louisiana Annual Drilling Activity Forecast

PARISH	Forecast of Total Annual Production Wells			Forecast of Total annual State & Fee Production Wells			Non-USFS		Forecast Annual Federal Production Wells
	Vertical	Horizontal	Dry Holes	Vertical	Horizontal	Dry Holes	Acres	Percent	
Plaquemines	31	30	5	28	28	5	59,189	8.3	3
LaFourche	20	18	5	20	18	5	0	0	0
Terrebonne	27	20	7	27	20	7	7,118	0.8	0
Cameron	22	18	5	18	15	4	189,024	18.4	4
Saint Mary	21	18	7	21	18	7	684	0.2	0
Vermilion	13	10	13	13	10	13	0	0	0
Calcasieu	19	18	10	19	18	10	0	0	0
Iberia	8	6	3	8	6	3	0	0	0
Jefferson Davis	10	5	4	10	5	4	0	0	0
Acadia	5	4	5	5	4	5	0	0	0
Saint Martin	1	1	0	1	1	0	17,476	3.4	0
Jefferson	5	4	2	5	4	2	15,419	7.2	0
Evangeline	7	5	0	7	5	0	0	0	0
Iberville	3	2	4	3	2	4	18,849	4.6	0
Beauregard	11	8	2	11	8	2	0	0	0
Saint Charles	0	3	1	0	3	1	15,207	6.40	0
Lafayette	0	0	0	0	0	0	0	0	0
Saint Bernard	2	2	4	2	2	4	0	0	0
Saint Landry	2	1	3	2	1	3	2,073	0.4	0
Assumption	0	1	0	0	1	0	0	0	0
Allen	3	2	3	3	2	3	0	0	0
Saint James	0	1	1	0	1	1	0	0	0
West Baton Rouge	2	0	0	2	0	0	0	0	0
Ascension	0	1	0	0	1	0	0	0	0
St. John the Baptist	0	0	1	0	0	1	23	0	0
Richland	0	0	0	0	0	0	0	0	0
West Feliciana	0	0	0	0	0	0	0	0	0
Orleans	0	0	0	0	0	0	21,843	16.0	0
TOTALS	**212**	**178**	**85**	**205**	**173**	**84**	**346,905**	**-**	**7**

Table 9: Statewide Forecast Oil and Gas Drilling Activity for Next Ten Years

Region	Forecast Total Production Wells			Forecast Total State & Fee Production Wells			Forecast Non-USFS Federal Wells			Forecast Total USFS wells		
	Vert.	Hor.	Dry	Vert.	Hor.	Dry	Vert.	Hor.	Dry	Vert.	Hor.	Dry
North	8,780	2,410	1,140	8,640	2,370	1,110	100	30	20	40	0	10
South	2,120	1,780	850	2,050	1,730	840	70	50	10	0	0	0
Total	**10,900**	**4,190**	**1,990**	**10,690**	**4,100**	**1,950**	**170**	**80**	**30**	**40**	**0**	**10**

8.0 REASONABLE FORESEEABLE DEVELOPMENT BASELINE SCENARIO ASSUMPTIONS AND DISCUSSION

This RFD scenario assumes that all potentially productive areas are open under the standard lease terms and conditions except those areas designated as closed to leasing by law, regulation, or executive order. The areas closed to leasing typically include Areas of Critical Environmental Concern (ACECs), Wilderness Study Areas (WSAs) and USFWS Wildlife Refuges. Within the State of Louisiana there are 27 USFWS refuges and no ACECs or WSAs that occur within the parishes that have federal development potential. The RFD scenario contains projections for the number or wells and acres disturbed for these parishes. This in no way is intended to imply that the BLM are making decisions about the Forest Service lands or the USFWS lands. The predictions are intended to provide the information necessary so that all potential cumulative impacts can be analyzed. The disturbance for each well is based on the typical depth of wells for an area; generally, shallow gas wells disturb fewer acres than deeper oil wells. The assumptions for conventional oil and gas are as follows:

The number of wells was calculated based on historical statistics and data trends as follows:

- Wells drilled to date were taken from the Louisiana Oil and Gas Commission’s public database.
- The number of wells drilled to date was statistically analyzed to calculate a median per year wells drilled per parish.
- The data trends associated with the last 7 years (2000-2006) represents a more accurate estimate of future development trends than historical data, thus, it is weighted more heavily.
- The data trends from 1992 to present data set are a more accurate estimate of future trends than the complete historical record and were weighted more heavily than the historical record.
- The data trends for the complete historical record represent the least acturate estimate of future development trends and, thus, it was weighted the lightest.
- For each geographic/geologic boundary region and sub region, the calculated estimates for future development were summed to obtain a per year well count.
- Wellhead oil and gas prices are a driving force for well drilling and completion; current prices are historically high and have resulted in increased activity throughout the state. An estimate of activity for the future well development to into consideration this influence. The forecast assumes wellhead oil and gas prices will remain high and development over the next 10 years will continue at an elevated rate.
- Estimates of well counts for the different mineral ownership entities are based on spatial analysis of the percent of mineral ownership within each parish times the total number of producing wells anticipated to be developed in that boundary area.
- The average acreage figure (acres per well) for the resource area was used to estimate federal disturbed acres.
- The RFD projections have a 10-year life.
- The number of dry holes was determined based on historic analysis of dry holes in the geologic boundary areas.

The assumptions were used to calculate the number of wells to be drilled, the number of in-field compressors, and the number of sales compressors required.

9.0 SURFACE DISTURBANCE DUE TO OIL AND GAS ACTIVITY ON ALL LANDS

9.1 Surface Disturbances

Estimates of the surface disturbances associated with the development of oil and gas on federal minerals within the State of Louisiana were determined from a variety of resources, including previous oil and gas environmental assessments, discussions with BLM and state oil and gas personnel, discussions with various operators, and document review.

The level of disturbance associated with conventional oil and gas development varies depending on the depth of the well and type of well drilled (horizontal vs. vertical). A shallow oil and gas well (<2,000 feet deep) typically includes a well pad of 2.0 acres, 0.10 miles of gravel road and 0.55 miles of utility lines for a total construction disturbance area of approximately 4.8 acres. Deeper oil and gas wells (5,000 to 12,000 feet below surface) require a greater disturbance area to accommodate the larger amount of equipment necessary to complete drilling. Usually a 3.25 acre well pad, 0.075 miles of gravel road, and 0.475 miles of utility lines for a total of 6.7 disturbed acres during the construction phase. Horizontal wells are typically drilled using a larger well pad estimated at 3.5 acres. However, the total construction disturbance for a horizontal oil and gas well is estimated to be 6.9 acres. This estimate is greater than the disturbance from deep oil and gas wells because the surface disturbance required for construction of both utility and transportation lines will be somewhat more for horizontal wells. Tables 10, 11, and 12 present surface disturbance estimates for conventional shallow and deep oil and gas wells and horizontal wells along with their associated support facilities. The data for surface disturbances from CBNG wells are presented in Table 13 below.

The surface disturbances are scaled to a per well disturbance level so that calculation of the total disturbance can be generated at the project, field, or parish level by multiplying the number of wells for analysis by the numbers provided in the table. Existing surface disturbances are commensurate with the estimates provided in Table 10, 11, 12, and 13.

9.2 Site Construction

The shortest feasible route is chosen to minimize haulage distances and construction costs while considering environmental factors and the surface owner's wishes. The access roads are typically constructed using bulldozers and graders to connect the existing road or trail and the drillsite. In some cases improvements such as cattle guards and culvert crossings are installed because of the terrain.

In the planning area the kind of drill rig and drilling depth varies and is determined by the geologic province and expected product from the well. The extent of surface disturbance necessary for construction depends on the terrain, depth of the well, drill rig size, circulating system, and safety standards. The depth of the drill test determines the size of the work area necessary, the need for all-weather roads, water requirements, and other needs. The terrain influences the construction problems and the amount of surface area to be disturbed. Reserve pit size may vary because of well depth, drill rig size, or circulating system.

Access roads to well sites usually consist of running surfaces 14 to 18 feet wide that are ditched on one or both sides. Many of the roads constructed will follow existing roads or trails. New roads might be necessary because existing roads are not at an acceptable standard. For example, a road may be too steep so that realignment is necessary.

Table 10: Level of Disturbance for Conventional Shallow Oil and Gas Wells and Associated Production Facilities

FACILITIES		Exploratory Well Disturbance (acres/well)	Construction Disturbance (acres/well)	Operation/ Production Disturbance (acres/well)
Well Pad (300-foot by 300-foot pad during drilling and construction, 175-foot by 175-foot pad during operation)		2.07	2.07	0.70
Access Roads to Well Sites	Two-track (12-foot wide by 0.25 miles long)	0.36	N/A	N/A
	Graveled (20-foot wide by 0.10 miles long for construction and operation)	N/A	N/A	0.24
	Bladed (20-foot wide by 0.10 miles for construction and operation)	N/A	0.24	0.0
Utility Lines	Water lines (15-foot by 0.20 miles)	N/A	0.18	0.0
	Overhead Elec. (10-foot by 0.15 miles)	N/A	0.12	0.03
	Underground Elec. (15-foot by 0.20 miles)	N/A	0.36	0.0
Transportation Lines	Intermediate Press. Gas line to and from field compressor (15-foot by 0.1 miles)	N/A	0.18	0.045
	High Press. Gas or Crude Oil Gathering Line (20-foot by 0.25 miles)	NA	0.61	0.15
Processing Areas	Tank Battery (one 0.50-ac tank battery per 20 wells)	N/A	0.025	0.025
	Access Roads (25-foot by 0.05 miles)	N/A	0.15	0.15
	Field Compressor (0.5-acre pad per 20 wells)	N/A	0.025	0.025
	Sales Compressor (2-ac pad for 150 wells)	N/A	0.01	0.01
	Sales Line (20-foot by 5 miles per 200 wells)	N/A	0.061	0.015
Produced Water Management	Produced Water pipeline (15-foot by 0.25 miles)	N/A	0.45	0.11
	Water plant/ Inj well (6 ac site per 20 wells)	N/A	0.3	0.3
Total Disturbance per Conventional Oil or Gas Well (acres)		**2.43**	**4.79**	**1.81**

1. The operation disturbance for utilities assumes all utilities will be completed underground, and the land surface will be reclaimed so that no disturbance should remain except where noted.
2. It is assumed that each conventional oil and gas well will need product pipeline and produced water line from the well. In addition, some wells will need intermediate pipeline run from the field compressor to sales line.

Table 11: Level of Disturbance for Conventional Deep Oil and Gas Wells and Associated Production Facilities

FACILITIES		Exploratory Well Disturbance (acres/well)	Construction Disturbance (acres/well)	Operation/ Production Disturbance (acres/well)
Well Pad (375-foot by 375-foot pad during drilling and construction, 200-foot by 200-foot pad during operation)		3.23	3.23	0.92
Access Roads to Well Sites	Two-track (12-foot wide by 0.5 miles long)	0.73	N/A	N/A
	Graveled (20-foot wide by 0.075 miles long for construction and operation)	N/A	N/A	0.18
	Bladed (20-foot wide by 0.075 miles for construction and operation)	N/A	0.18	N/A
Utility Lines	Water lines (12-foot by 0.20 miles)	N/A	0.29	0.0
	Overhead Elec. (10-foot by 0.075 miles)	N/A	0.09	0.023
	Underground Elec. (15-foot by 0.20 miles)	N/A	0.36	0.0
Transportation Lines	Intermediate Press. Gas line to and from field compressor (15-foot by 0.075 miles)	N/A	0.14	0.034
	High Press. Gas or Crude Oil Gathering Line (25-foot by 0.5 miles)	NA	1.21	0.30
Processing Areas	Tank Battery (one 0.50-ac tank battery per 15 wells)	N/A	0.03	0.03
	Access Roads (25-foot by 0.05 miles)	N/A	0.15	0.15
	Field Compressor (0.5-acre pad per 15 wells)	N/A	0.03	0.03
	Sales Compressor (2-ac pad for 150 wells)	N/A	0.01	0.01
	Sales Line (25-foot by 6 miles per 150 wells)	N/A	0.12	0.12
Produced Water Management	Produced Water pipeline (15-foot by 0.25 miles)	N/A	0.45	0.11
	Water plant/ Inj well (6 ac site per 15 wells)	N/A	0.40	0.40
Total Disturbance per Conventional Oil or Gas Well (acres)		**3.96**	**6.71**	**2.24**

1. The operation disturbance for utilities assumes all utilities will be completed underground, and the land surface will be reclaimed so that no disturbance should remain except where noted.
2. It is assumed that each conventional oil and gas well will need product pipeline and produced water line from the well. In addition, some wells will need intermediate pipeline run from the field compressor to sales line.

Table 12: Level of Disturbance for Horizontal Gas Wells and Associated Production Facilities

FACILITIES		Exploratory Well Disturbance (acres/well)	Construction Disturbance (acres/well)	Operation/ Production Disturbance (acres/well)
Well Pad (360-foot by 360-foot pad during drilling and construction, 200-foot by 200-foot pad during operation)		2.98	2.98	0.92
Access Roads to Well Sites	Two-track (15-foot wide by 0.25 miles long)	0.45	N/A	N/A
	Graveled (15-foot wide by 0.15 miles long for construction and operation)	N/A	0.0	0.27
	Bladed (15-foot wide by 0.15 miles for construction and operation)	N/A	0.27	0.0
Utility Lines	Water lines (15-foot by 0.5 miles)	N/A	0.90	0.0
	Overhead Elec. (10-foot by 0.15 miles)	N/A	0.18	0.045
	Underground Elec. (15-foot by 0.15 miles)	N/A	0.27	0.0
Transportation Lines	Intermediate Press. Gas line to and from field compressor (15-foot by 0.25 miles)	N/A	0.45	0.11
	High Press. Gas or Crude Oil Gathering Line (20-foot by 0.5 miles)	NA	1.21	0.30
Processing Areas	Tank Battery (one 0.50-ac tank battery per 16 wells)	N/A	0.031	0.031
	Access Roads (25-foot by 0.05 miles)	N/A	0.15	0.15
	Field Compressor (0.5-acre pad per 16 wells)	N/A	0.031	0.031
	Sales Compressor (2-ac pad for 128 wells)	N/A	0.016	0.016
	Sales Line (20-foot by 4 miles per 128 wells)	N/A	0.075	0.019
Produced Water Management	Discharge Point	N/A	N/A	N/A
	Storage Impoundment (20 acres each serving 64 wells)	N/A	0.31	0.31
Total Disturbance per Conventional Oil or Gas Well (acres)		**3.43**	**6.90**	**2.21**

1. The operation disturbance for utilities assumes all utilities will be completed underground, and the land surface will be reclaimed so that no disturbance should remain except where noted.
2. It is assumed that each conventional oil and gas well will need product pipeline and produced water line from the well. In addition, some wells will need intermediate pipeline run from the field compressor to sales line.

Table 13: Level of Disturbance for Horizontal Gas Wells and Associated Production Facilities (4 Wells per Pad)

FACILITIES		Exploratory Well Disturbance (acres/pad)	Construction Disturbance (acres/pad)	Operation/ Production Disturbance (acres/pad)
Well Pad (540-foot by 500-foot pad during drilling and construction, 200-foot by 200-foot pad during operation)		6.20	6.20	0.92
Access Roads to Well Sites	Two-track (15-foot wide by 0.25 miles long)	0.45	N/A	N/A
	Graveled (15-foot wide by 0.15 miles long for construction and operation)	N/A	0.0	0.27
	Bladed (15-foot wide by 0.15 miles for construction and operation)	N/A	0.27	0.0
Utility Lines[1]	Water lines (15-foot by 0.5 miles)	N/A	0.90	0.0
	Overhead Elec. (10-foot by 0.15 miles)	N/A	0.18	0.045
	Underground Elec. (15-foot by 0.15 miles)	N/A	0.27	0.0
Transportation Lines[2]	Intermediate Press. Gas line to and from field compressor (15-foot by 0.25 miles)	N/A	0.45	0.11
	High Press. Gas or Crude Oil Gathering Line (20-foot by 0.5 miles)	NA	1.21	0.30
Processing Areas	Tank Battery (one 0.50-ac tank battery per 16 wells)	N/A	0.125	0.125
	Access Roads (25-foot by 0.05 miles)	N/A	0.15	0.15
	Field Compressor (0.5-acre pad per 16 wells)	N/A	0.125	0.125
	Sales Compressor (2-ac pad for 128 wells)	N/A	0.063	0.063
	Sales Line (20-foot by 4 miles per 128 wells)	N/A	0.30	0.076
Produced Water Management	Discharge Point	N/A	N/A	N/A
	Storage Impoundment (20 acres each serving 64 wells)	N/A	1.25	1.25
Total Disturbance per Horizontal Oil or Gas Well (Total acres divided by 4 wells per pad)		**1.66 per well**	**2.87 per well**	**0.86 per well**

1. The operation disturbance for utilities assumes all utilities will be completed underground, and the land surface will be reclaimed so that no disturbance should remain except where noted.
2. It is assumed that each conventional oil and gas well will need product pipeline and produced water line from the well. In addition, some wells will need intermediate pipeline run from the field compressor to sales line.

Table 13: Level of Disturbance for CBNG Wells and Associated Production Facilities

FACILITIES		Exploratory Well Disturbance (acres/well)	Construction Disturbance (acres/well)	Operation/ Production Disturbance (acres/well)
Well Pad (100-foot by 100-foot pad during drilling and construction, 200-foot by 200-foot pad during operation)		0.25	0.25	0.05
Access Roads/ Routes to Well Sites	Two-track	N/A	0.30	0.30
	Graveled	N/A	0.10	0.10
	Bladed	0.75	0.075	0.10
Utility Lines	Water	N/A	0.35	----[1]
	Overhead Elec.	N/A	0.20	0.20
	Underground Elec.	N/A	0.35	----
Transportation Lines	Low Pressure Gas	N/A	0.90	----
	Intermediate Pres. Gas	N/A	0.25	----
Processing Area	Battery Site	N/A	0.020	0.020
	Access Roads	N/A	0.15	0.15
	Field Compressor	N/A	----	0.02 (0.5 acres / 24 producing wells)
	Sales Compressor	N/A	----	0.005 (1.0 acres / 240 producing wells)
	Plastic Line	N/A	----	0.5[2]
	Gathering Line	N/A	----	0.25
	Sales Line	N/A	----	0.075
Produced Water Management	Discharge Point	N/A	0.01	0.002
	Storage Impoundment	N/A	0.3	0.25
Total Disturbance		1.0	3.25	2.0

1. The operation disturbance for utilities assumes all utilities will be completed underground, and the land surface will be reclaimed so that no disturbance should remain except where noted.

2. Plastic lines within the processing area are assumed to disturb an average corridor with of 25 feet.

Roads can be permanent or temporary, depending on the success of the well. The initial construction can be for a temporary road; however, it is designed so that it can become permanent if the well produces. Not all temporary roads constructed are rehabilitated when the drilling stops. A temporary road is often used as access to other drill sites. The main roads and temporary roads, require graveling to be maintained as all-weather roads. This is especially important in the spring. Access roads may be required to cross public lands to a well site located on private or state lands. The portion of the access road on public land would require a BLM right-of-way.

Most conventional wells are drilled from a fixed platform while the majority of CBNG wells are drilled using a truck-mounted rig. Site preparation generally takes about a week before the drill rig is assembled. For moderate depth oil wells drilling generally takes 2 to 4 weeks, although deeper wells may require longer drilling time because of the geologic formations encountered. Wells drilled from a platform require more surface preparation and cause disturbance to a larger area for the ancillary facilities. CBNG wells are usually drilled in under a week and site preparation is typically less than for conventional wells.

Approximately 1 to 4 acres are impacted by well site construction. The area is cleared of large vegetation, boulders, or debris. Then the topsoil is removed and saved for reclamation. A level area from 1 to 4 acres is then constructed for the well site, which includes the reserve pit.

The well pad is constructed by bulldozers and motor scrapers. The well pad is flat (to accommodate the drill rig and support equipment) and large enough to store all the equipment and supplies without restricting safe work areas. The drill rig must be placed on “cut” material rather than on “fill” material to provide a stable foundation for the rig. The degree of cutting and filling depends on terrain; that is, the flatter the site, the less dirt work is required.

Hillside locations are common, and the amount of dirt work varies with the steepness. A typical well pad will require a cut 10 feet deep against the hill and a fill 8 feet high on the outside. It is normal to have more cut than fill to allow for compaction, and any excess material is then stockpiled. Eventually, when the well is plugged and abandoned, excavated material is put back in its original place.

Reserve pits are normally constructed on the well pad. Usually the reserve pit is excavated in “cut” material on the well pad. The reserve pit is designed to hold drill cuttings and used drilling fluids. The size and number of pits depends on the depth of the well, circulating system and anticipated down hole problems, such as excess water flows.

Reserve pits are generally square or oblong, but may be irregular in shape to conform to terrain. The size of reserve pits for deeper wells can be reduced by the use of steel mud tanks. For truck-mounted drill rigs used in shallow gas fields, a small pit (called the blooie pit) is used. Most or all of the reserve pit is located in the cut location of the drillsite for stability. When the drillsite is completed, the rig and ancillary equipment are moved on location and drilling begins.

The reserve pit can be lined with a synthetic liner to contain pit contents and reduce pit seepage. Not all reserve pits are lined; however, BLM often requires a synthetic liner depending upon factors such as soils, pit locations, ground water and drilling mud constituents. The operator can elect to line the reserve pit without that requirement.

An adequate supply of water is required for drilling operations and other uses. The sources of water can be a well at the drill site or remote sources such as streams, ponds, or wells. The water is transported to the site by truck or pipeline. Pipelines are normally small diameter surface lines. The operator must file for and obtain all necessary permits for water from the state. On public lands an operator must have the BLM’s permission before surface water can be used.

9.3 Mitigation Measures

Mitigation measures are restrictions on lease operations, which are intended to minimize or avoid adverse impacts to resources or land uses from oil and gas activities. Mitigation measures would be included as appropriate to address site-specific concerns during all phases of oil, gas and CBNG development.

9.4 Conditions of Approval

An approved application for permit to drill (APD) includes conditions of approval (COA), and Informational Notices which cite the regulatory requirements from the Code of Federal Regulations, Onshore Operating Orders and other guidance. Conditions of approval are mitigation measures which implement lease restrictions to site specific conditions. General guidance for COA are found in the BLM and U.S. Forest Service brochure entitled “Surface Operating Standards for Oil and Gas Exploration and Development” (USDI, BLM 1989) and BLM Manual 9113 entitled “Roads”.

9.5 Lease Stipulations

Certain Resources in the planning area require protection from impacts associated with oil and gas development. The specific resources and methods of protection are contained in lease stipulations. Lease stipulations usually consist of no surface occupancy, controlled surface use, or timing limitations. A notice may be included with a leased to provide guidance regarding resources or land use. While actual wording of stipulations may be adjusted at the time of leasing, the protection standard described will be maintained.

9.6 Total Disturbances

The disturbances for the RFD scenario over the next 10 years have been calculated and are displayed in Tables 15 and 16. Table 15 address the disturbances from exploration and construction activities for types wells anticipated to be developed in the northern and southern regions of the state. Estimates for horizontal gas and deep oil & gas, and multiple horizontal wells from single pads have been extrapolated. The total disturbances for all predicted wells are estimated at 97,830 acres. Disturbance from federal mineral development would be 1,880 acres of which 268 acres would be on USFS lands. The remaining federal disturbance (1,612 acres) would be on military sites, national park lands, and USFWS refuges. The disturbance to state and fee lands would be 95,889 acres.

Table 16 depicts the residual disturbance by well type remaining after appropriate mitigation measures and site restoration or rehabilitation activities have taken place. The total residual disturbance from anticipated development activities is 32,262 acres of which 620 would be from federal mineral development. The federal disturbances would affect 90 USFS acres and 531 acres of various surface agencies. State and fee residual disturbance would be 31,623.

The mitigation of initial exploration and construction disturbances would equal nearly 65,568 acres. Mitigation measures would account for remediation of 1,260 federal acres, and 64,266 state and fee acres.

Table 14: Predicted Development and Surface Disturbance (Exploration and Construction) for Wells

Well Type	Total Wells Drilled	Dry Holes	Disturbance per Dry Hole	Total Dry Hole Disturbance	State & Fee Producing Wells	Disturbance per State/Fee Well	Total State/Fee Disturbance	Federal Producing Wells	Disturbance per Federal Well	Total Federal Disturbance	USFS Producing Wells	Disturbance per USFS Well	Total USFS Disturbance	Total Producing wells	Total Disturbance
Gas – horizontal	3,221	79	3.43	270.97	3075	6.90	21,217.50	60	6.90	414.00	0	6.90	0	3,143	21,686.70
Gas – horizontal (4 from single pad)	1,074	26	1.66	43.16	1025	2.87	2,941.75	20	2.87	57.40	0	2.87	0	1,047	3,004.89
Gas/Oil – deep	12,786	1885	3.96	7464.60	10,690	6.71	71,729.90	170	6.71	1,140.70	40	6.71	268.40	10,900	73,139.00
Gas – shallow	0	0	2.43	0	0	4.79	0	0	4.79	0	0	4.79	0	0	0
CBNG	0	0	1.0	0	0	3.25	0	0	3.25	0	0	3.25	0	0	0
CBNG – horizontal	0	0	3.43	0	0	6.9	0	0	6.9	0	0	6.9	0	0	0
Total	17,080	1,990		7,778.73	14,790		95,889.15	250		1,612.10	40		268.40	14,190	97,830.59

Assumptions:

Disturbance per well includes the well pad plus incremental roads, utility lines, transportation lines, processing equipment areas, and produced water management as outlined in Tables 11,12,13,& 14 for exploration.

Table 15: Predicted Development and residual Surface Disturbance (Production) for Wells

Well Type	Total Wells Drilled	State & Fee Producing Wells	Disturbance per State/Fee Well	Total State/Fee Disturbance	Federal Producing Wells	Disturbance per Federal Well	Total Federal Disturbance	USFS Producing Wells	Disturbance per USFS Well	Total USFS Disturbance	Total Producing wells	Total Disturbance
Gas – horizontal	3,221	3,075	2.21	6,795.75	60	2.21	132.60	0	2.21	0	3,143	6,946.03
Gas – horizontal (4 from single pad)	1,074	1,025	0.86	881.50	20	0.86	17.20	0	0.86	0	1,047	900.42
Gas/Oil – deep	12,786	10,690	2.24	23,945.60	170	2.24	380.80	40	2.24	89.60	10.900	24416.00
Gas – shallow	0	0	1.81	0	0	1.81	0	0	1.81	0	0	0
CBNG	0	0	2.0	0	0	2.0	0	0	2.0	0	0	0
CBNG – horizontal	0	0	2.21	0	0	2.21	0	0	2.21	0	0	0
Total	17,080	14,790		31,622.85	250		530.60	40		89.60	14,190	32,262.45

Assumptions:

Disturbance per well is the residual disturbance remaining after the mitigation measures have been implemented.

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APPENDIX A

Western Gulf Province (047) Description Of Plays

East Texas Basin Province (048) and Louisiana-Mississippi Salt Basins Province (049)